RAILROAD GAZETTE

FRIDAY, FEB. 23, 1894

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Contributions.

Strikes.

BRIDGEPORT, Conn., Feb. 16, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your article entitled "The Union Pacific Injunction Against Strikes," of Feb. 16, you say: "However legitimate such strikes or proceedings might be if there were no receivers in the case," etc.

Do you, then, consider strikes "legitimate"? And does the presence or absence of a receiver in the management of a road change the "legitimacy" of a strike? Your language would seem to imply that it did. The business of a railroad is legitimate because it is according to law, permitted and granted executive authority to supply a legal and necessary public convenience. A strike is a combination or conspiracy to subvert, obstruct and forcibly hinder a lawful business from being continued and carried on, and, whether directed against a public corporation or a private company, is almost always a direct loss and inconvenience (to use very mild terms) to the general public. How then can such a conspiracy under any circumstances be defined as "legitimate"? There should be no confusion between the right of the individual and the forcible demand of a cabal. The *Railroad Gazette* is so careful and conservative in its statements generally, that your readers would no doubt gladly hear from you in explanation on this point.

E. D.

[Surely a strike of railroad employees may be legitimate. Like railroad business, it can be conducted "according to law."—EDITOR RAILROAD GAZETTE.]

Automatic Signal Patents.

The Hall Signal Company,
NEW YORK, Feb. 20, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It has just come to our notice that the Union Switch & Signal Company is engaged in notifying the various railroad companies to whom we are supplying the Hall Automatic Block Signal, that the Hall Signal Company is infringing upon certain of the Union company's patents in the installation of the Hall work. We are also informed that the Union company states that all roads using the Hall system will be compelled to pay a royalty on account of such alleged infringement. Such claims are entirely devoid of any basis in fact. Our signaling system which is claimed to infringe on the Union patents has been in extensive use for several years. If this system is an infringement on these patents, why has the Union company never brought suit against us? The devices used by our company are the original inventions of persons connected with the company, and are fully covered and protected by existing patents owned by us. We have always been careful not to infringe on patents of others. Not only is it true that we do not infringe, but it is also a fact, as we are informed, that the Union company infringes upon at least one important patent which we own.

We exceedingly regret that the Union people should feel constrained by stress of circumstances to make this attack upon the Hall Signal Company and its railroad customers at this time, inasmuch as it displays weakness on their part, so closely following the adoption of the Hall automatic normal danger track circuit system of block signals by the Delaware, Lackawanna & Western. This latter fact demonstrates more thoroughly than ever that the Hall signal, in practice, fully meets all claims that we have made for it, and that it is the only perfectly reliable and thoroughly efficient automatic block signal on the American market to day. President Sloan, of the Lackawanna, having distinctly stated that his executive committee were thoroughly convinced, as the result of their exhaustive investigation of the various signal systems, that the Hall was the best in use.

The writer desires to take this occasion to state that it has always been, and is now, the policy of the company he represents to avoid making any demands upon railroad companies for damages on account of infringement cases, and that, in view of this fact, and the further fact that we have always endeavored to deal honorably, truthfully and squarely by our railroad customers, giving value received in all cases, we sincerely trust that no encouragement may be given by any railroad interest to the attack that is now being made upon us by our competitors. WM. P. HALL, *President.*

The Uses of the Transition Curve.

TO THE EDITOR OF THE RAILROAD GAZETTE.

Your comment on my short notes in your issue of Jan. 26 indicates that you have not caught the meaning of those notes. . . . "Tangent" first rode a bicycle in 1868, and as yet has never felt any ease in curving because of some lighter curve he had left several hundred feet behind. I invite you to prove that a transition curve has any effect on a train that is well off it and on the main curve. On the contrary, this main curve is a trifle sharper than if the curvature had been equally distributed over the whole distance, though not materially so in most cases. The resultant you speak of was stated in my notes, in the last paragraph, to be desirable by the terms there used. The widely prevalent notion that the use of a transition curve accustoms the train to running in a curved direction has led to many needless refinements in transition work. When a transition curve has brought a train up to the lateral elevation suited to the main curve, and has done so without abruptness, it has done all it can do for the train. TANGENT.

[It is difficult to gather from "Tangent's" letter whether or not he advocates the use of transition curves at all. The object of a transition curve is to get the train from the tangent to the main curve without shock. We know of no "prevalent notion" that a transition curve imparts any peculiar property to a train which affects its motion after it is "several hundred feet" off from the curve. If any one held such a view, we should expect him to begin every division of the road with a transition curve.—EDITOR RAILROAD GAZETTE.]

Car Seals and Car Construction to Prevent Thieving.

SPRINGFIELD, Mass., Jan. 29, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Notwithstanding the improvement made in recent years in the manufacture of freight cars, some cars even now, with their sealed doors, are very apt to remind one of the famous hen-coop, with its bright lock and—leather hinges. But it is no fault of a good seal that the requisite security is not obtained. The construction of the doors and fastenings of the cars; the presses and seals used; the character of the help employed, all have much to do with failures. Many staples can be removed easily with a nail, and a thief could enter a car so secured, take what he chose, put the staple back and leave no outside trace. Many car-door hasps are fastened merely by two screws. Some cars can be entered through the roof by raising the boards. A common plan is, while the car is standing, to lift one end of the door from its bearing, when there will be a sufficient space to enter. This plan was worked extensively recently on a prominent road. By all the methods mentioned, the seal need not be disturbed, and from years of observation, I believe the seal to be seldom meddled with. Thieves do not like to tamper with it. It is better than a lock, on account of its detective feature, but it cannot atone for the deficiencies of the cars themselves.

There are plenty of cars as safe from intrusion as an ordinary dwelling house, and it would materially lessen complaint and annoyance if all were so. Bolt or clinch the old-fashioned staples on the cars when in the shops, or use one of the numerous ingenious and cheap patented latches and doors. Clamp the door bearings on the running rail, or secure the door at top so that it cannot be lifted. Line the roof with corrugated iron, or otherwise. This latter plan also prevents the cars from leaking. Some freight cars are nearly invulnerable.

Given a corresponding efficiency in the cars themselves; sealers, faithful and experienced; good presses, seals, wires, etc., the device of the seal will meet all that is ever claimed for it, and it is probably as ingenious, thorough, and inexpensive a plan for carrying out a particular purpose as can well be conceived.

Many railroads seem to depend much on a kind of detective espionage over their men. Some furnish the conductors with sealing paraphernalia, and hold them more directly responsible. A general bounce of brakemen is not uncommon, but the pilferings continue. Fasten the rogues out, as securely as possible, is the more rational way. Experience shows that a good seal can be depended on. To seal all kinds of cars properly requires practice. Send a laborer to seal a car and it is an even chance that the task will have to be done over.

JOHN A. DEARDEN.

Railroad Relief Associations.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with much interest your editorial on the above subject in the *Railroad Gazette* of Feb. 16.

The "Relief" may be viewed as an Insurance Association, but more properly as a vast subscription by the employees for mutual aid. It is, therefore, not based on the relative risks of its members, as an insurance association is or may be, but upon the nearest practicable approach to the ability of members as measured by their wages, coupled with the desire of each as to the amount of personal protection for himself. It thus takes the place of subscription papers, which have always been circulated among men so freely, to aid their fellows in distress, and of appeals to the company for charity; and gives to men a title to relief, when they need it, instead of making them beg for it; and the relief is of a more extended and substantial character than that gained usually by such appeals. It is also to be noted that these Relief Associations provide for benefits during sickness, the payments for which are often double those for accident, as shown by their reports.

Regarding the attitude of the company as respects liability, the *consideration* is much more than the amount represented by the deficiency. There is a large, constant and direct payment of the operating expenses for officers, clerks, medical men, etc., and indirectly by the employment in the work of the Relief of those who are in positions not directly connected with it and the use of the company's offices and transportation for facilitating operations. These Relief arrangements too are usually accompanied by the guarantee of the corporation, which supplies a stability that mutual associations of employees cannot secure, as is shown by their numerous failures.

Again, railroad men are subject to injury and death from many accidental causes for which the company is not at all liable. Suit in such cases results in expense and disappointment. Even where there may be possible ground for suit, it may go against the claimant. Where there is no suit or thought of it, the man, or the family left by him, in the absence of this special provision, gets no relief.

The law is uncertain at best. The Relief disposes of the uncertainty and provides a certainty for all. If the company does possibly pay out less than it might if subjected to suits for damages (which may or may not be the case) much goes for fees and other court expenses and much that claimants get by suit goes in the same way, while many injured, and families of the dead, get nothing. The Relief plan offers something to all and in securing it the company pays for the general benefit what it might otherwise be compelled to pay in antagonizing its men.

If, as is professed, the laboring men wish a sympathetic feeling between them and their employers, this is certainly one of the best means of bringing it about. This state of things is certainly desirable, and intelligent opposition to it can only come from those who do not want the laboring man to be on good terms with his employer.

In large corporations the distance of men from the responsible head is so great that the human element has little opportunity to manifest itself; cold business governs. These Relief departments are a valuable means of relieving much of the tension that has come to exist, and of showing in a substantial way an interest that must produce a state of good feeling that is needed for the good of both the employer and the employee.

P. T. R.

Rapid Transit in New York City.

The following brief study of the rapid transit problem is by a well-known and accomplished engineer, who has given careful attention to the subject. As the New York Chamber of Commerce is asked to pronounce an opinion, on two weeks' notice, upon a matter which the Rapid Transit Commissioners have not been able to make up their minds upon, after three years' study, these words of suggestion and caution will be timely.

Medium speed transit and rapid transit are two different things. The first we have, and building more elevated lines will not only not give us the second, but will absolutely postpone it. Rapid transit means few stops. Few stops mean loss of short distance passengers. Loss of these, which are more than three-quarters of the whole, means insufficient revenue, and hence application for public aid.

There are three ways (beside the Wilson plan) in which such aid can be given. One is to permit fares higher than five cents for express trains. Public opinion does not sanction this. A second way would be to grant to a private company a franchise to build a two track subway below, and a two track elevated line above, Broadway, with tickets, interchangeable, at one fare of five cents. The great profits of the local traffic on a Broadway elevated line would recoup the losses on the subway traffic, while the first cost and interest charges would be greatly diminished. But public opinion is probably not ripe for sanctioning an elevated line on Broadway; although it can easily be shown that a two-track light structure fitted for electric motor cars would not be nearly so much of an obstruction as are the pres-

ent elevated railroads, and should not be compared with them.

The only other way is for the city to build and own its subways and lease them to an operating company when built. This could be done in either of two ways—by the present machinery of the city government, which has built the new Aqueduct and several large bridges, or by including in the operating lease the construction of the subway, under proper restrictions, as suggested by Mr. Hewitt. In either case the sum which the city should properly pay would be less than the 35 millions asked for under the Wilson plan, and instead of the city's merely owning an equity in the subway, it would be the the absolute owner of it, from which it could eject the operating company if at any time it did not fulfill the terms of its lease.

This is the way in which it can be done: On the east side there should be an independent two-track subway for express trains from the New York Central Station at Forty-second street to City Hall, running under streets east of Broadway. If no arrangement could be made with the New York Central to operate this in connection with its suburban trains, then the subway would have to be continued to the Harlem River and beyond. Much more traffic comes now, and always will come, from the east side than from the west, owing to the level nature of the ground, which admits of much closer building than is possible on the hills of the west side. For the present, however, we will only consider the cost of a subway south of Forty-second street on the east side, and on the west side from the Battery northward.

Under Broadway, from the Battery to Sixty-fifth street, and including a loop at City Hall, should be built a four-track subway, for express and local traffic, substantially as designed by the Rapid Transit Commissioners, who have given great care and study to their plan, which, for that locality, is probably the best possible.

At Sixty-fifth street, after passing the Manhattan elevated railroad, the road should rise from subway to elevated, which could be done without obstruction, on account of the great width of the Boulevard. From this point northward, there should be a first-class four-track elevated railroad. As a matter of fact, much heavier trains than would ever be run on this line are run daily at speeds of 40 miles an hour and over on railroad viaducts in all parts of the country. The Boulevard and Eleventh avenue are wide streets, and the obstruction to light and air from this viaduct would be very little. After reaching a certain distance no viaduct is required, but the line can run on the ground either on embankment or in cutting, the cross streets being carried above and below, all as planned by the Rapid Transit Commissioners.

What will such a system cost? A four-track subway such as has been described would be 9½ miles long, and could be built for $25,000,000. The private company leasing it would have to build above Sixty-fifth street 11 miles of four track railroad, chiefly elevated, but some parts of it on the surface. This would cost $7,000,000. Add to this, electric equipment, power stations and land, $6,000,000, and we have a total of $13,000,000.

How much could the lessee pay the city? In 1886 the Manhattan carried 115,109,581 passengers, at a cost, exclusive of taxes, of 3.31 cts. each. The double track mileage of the new line would be about equal to the Manhattan, say 40 miles. It is fair to assume that owing to better gradients, greater concentration of traffic and the use of more modern appliances, the new line could carry 112 million passengers, half the present traffic of the Manhattan, for three cents each. Thus we have:

Receipts.		
112,000,000 passengers at 5 cents		$5,600,000
Expenses.		
112,000,000 passengers at 3 cents	$3,360,000	
Rent to city, 5 per cent. on $25,000,000	1,250,000	4,610,000
Net earnings		$990,000
This would pay:		
Interest on $6,000,000 bonds at 5 per cent.	$300,000	
Dividend on $7,000,000 stock at 8 per cent	560,000	
Taxes	130,000	
		$990,000

with a prospect of unlimited increase.

Any private company taking the lease of the subway should be bound to build the elevated line and to run not less than a certain number of cars daily, properly lighted and heated, and at not less than certain agreed on speeds. On the other hand the city should guarantee that no change of fares nor increase of taxation should be made during a specified time. Also that no other franchise should be granted to build elevated lines until it had been offered to and declined by the company leasing the subway. If such conditions are announced there will be no lack of capital competing for the lease of the subway, certainly at three per cent. and possibly at five per cent. on its cost, and for the construction of the elevated line as its extension.

I have briefly indicated what I think ought to be done, and I will now say what ought *not* to be done. The aid of the city should not be given to any plan which does not give the city absolute ownership of the subway, and control of the number and speed of the trains. Franchises for any more elevated railroads should not be given, except to that company which will lease the subway and operate rapid transit trains. In other words, do not give away valuable local traffic, except to those who will assume less valuable long distance traffic. This is the key to the whole situation.

The Columbian Metallic Tie and Guard Rail.

The chief advantage of the Columbian metallic tie, fig. 1, is its simple construction: it has neither bolts, rivets, nor keys. It is made of steel, the bed plates being ¼ in. thick, and the tie-bar ⅝ in.; the bed plate of the main-line tie is 12 in. long, 10 in. wide at the top, flaring to 15 in. at the bottom, and is cut away on the inside flange to admit of perfect tamping. The tie-bar is 3 in. high and 4 in. wide on the bottom. The joint tie is a modification of the main line tie, the chief difference being that the bed plate is 20 in. long, with two angled tie-bars instead of one T bar.

Where strength is specially required (on the inside of the rail), two lugs are used in the intermediate or main line tie, and three in the joint tie, to clamp the rail; the middle lug is double the width of the others and covers the joint.

The bearing of the rail on the plate is greater than in wooden ties; it is sufficient to allow the ties to be placed 30 in. apart center to center, leaving but 18 in. between bearings and it is placed where it will give most service under the rail, and has not the objectionable features of a continuous support. Only 2,112 of these ties are required to the mile, against 2,640 or more of wooden ties.

Sufficient rigidity is secured without sacrificing a certain amount of elasticity, which is desirable. The tie being buried in the roadbed, lateral displacement, either on tangents or curves, need not be feared; the anchorage is all that the construction of a railroad tie will permit.

The spike fastening of wooden ties has always been considered insecure and objectionable, and the lug of the spike is very small compared with the size of the spike. The area of each lug of the Columbian metallic tie has a resistance to displacement of the rail equal to three spikeheads, while the rail seat and lateral fastening make rail spreading an impossibility. The effect of the whole arrangement is to present a mechanical automatic clamp increasing in effectiveness with the amount of weight upon it, and holding the rail firmly at all temperatures. The vibration is so completely minimized that the amount of wear ceases to be a factor. Oxidization takes place very slowly.

The main-line tie weighs from 85 to 90 lbs., and the joint tie weighs about 120 to 125 lbs., and the minimum life of the ties is probably 30 years.

The Columbian metallic bridge ties for bridges and elevated railroads with wooden stringers, are placed 5 ft. apart, center to center, rail chairs and braces being used between. The inside lug of the tie plate is constructed with a tongue which fits into a groove on the inside of the stringer, and it is secured to the stringer by means of a wedge, which is placed between the outside limb of the plate and the stringer; this makes the ties perfectly secure.

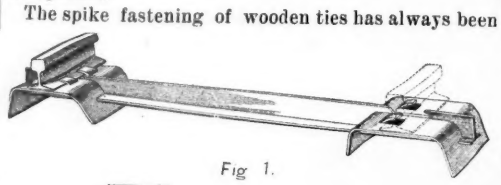


Fig. 1.

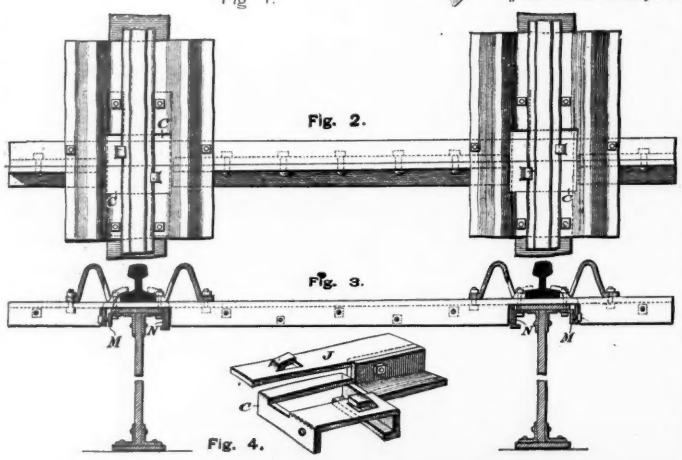


Fig. 2.

Fig. 3.

Fig. 4.

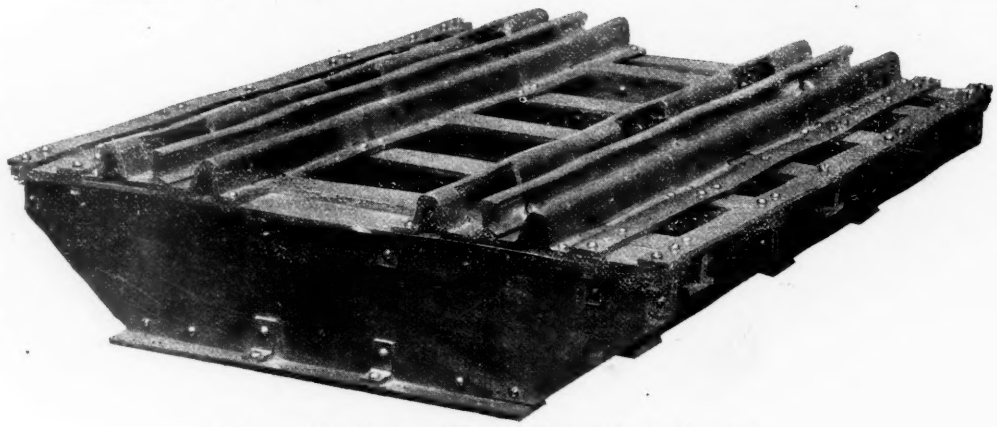


FIG. 5—COLUMBIAN METALLIC TIE AND GUARD RAIL.

The operation of replacing a rail is very simple and can be accomplished in one-fourth the time required to replace a rail with wooden stringers. The cost of these ties compared with that of wooden ties for bridge purposes is about 10 per cent. less.

The Columbian combination metallic tie and guard rail, shown in figs. 2, 3, 4 and 5, for girder bridges and elevated railroads, is constructed with a tie plate somewhat similar to that of the plate for wooden stringers, but in place of the wedge a set screw is used, which clamps the flange of the rail securely. With this arrangement a rail can be replaced in less time than is required with the tie for wooden stringers. The guard rail is made of a sheet of steel ¼ in. in thickness, having two crimps of the height of the rail, figs. 2 and 3. The central part of the guard rail is flat, and the rail proper rests on this flat portion, between the two crimps, thus forming a channel on each side of the rail, so that in case of derailment cars may pass over a bridge without coming in contact with the girders or the ties. The gage between the corresponding guards on each rail is the same as that of the rail proper; should the rails mount the guard, there is thus prepared a substitute for the rail in crossing a bridge thus constructed.

An earlier form of these ties has been in use with good results in a limited way, but sufficient to determine their practicability, and to suggest changes of form in some minor details, which are incorporated in the present forms. The makers have recently received a number of orders for spring delivery.

These ties are controlled by the American Railway Maintenance Syndicate, with offices at 1109 and 1110 Betz Building, Broad and South Penn Square, Philadelphia, where large models showing the full system may be examined.

Cableways for Hoisting and Conveying.*

Mr. Miller's paper limited the treatment of the subject of cableways to those hoisting and conveying devices which employ a suspended cable as a trackway in distinction from the wire rope tramways which have only a capacity of hauling. The subject was illustrated by about 50 lantern slides, and the mechanisms and devices were explained and described by these stereopticon views. The subject was treated chronologically, and the first cableway shown and described was one invented by Mr. Schennan in 1860, and now extensively used in the slate quarries of Pennsylvania and Vermont. Then followed views showing the development of the fall rope carrier from its earliest form to the present standard devices.

These illustrations included the single triangular carrier used on inclined cableways, the chain-connected carriers as used at the Brandywine Granite Quarries and on the Sodom Dam, the early form employing buttons as stops at the Tilly Foster Iron Mine, and the horizontal carrier employed at Ogden, N. J. The necessity of providing carriers for the fall rope or hoisting rope is to insure that the block shall descend when the hoisting rope is slacked. If it be not supported between the engine and the carrier it will sag and hang in a catenary instead of passing through the carrier pulley and allowing the block to descend. The breaking of the cable at Sodom Dam was mentioned, and it was given as good practice to have the sag of a cable about one-twentieth of the span. Numerous views were shown of works in various stages of progress where cableways are used; among others those of the phosphate mines of Florida, the building of a lock and dam by the government on the Coosa River, and one recently erected over the Kanawha River, Point Pleasant, W. Va., for a similar purpose. The latter cableway has an unprecedented span of 1,505 ft., and spans the site of the dam, a portion of the lock, the quarry and a coal mine. It possessed the great advantage of being far above high water and out of the way of the river boats. These views were followed by others showing the cableway in use to convey materials to a stone arch bridge in Rochester, N.Y., and to illustrate its advantage in constructing a stone arch bridge over railroad tracks in Baltimore.

An adaptation of the cableway that was specially interesting is to that of a steam shovel. This is accomplished by attaching to the fall block a scoop or bucket

* An abstract of a paper read before the American Society of Civil Engineers at the annual meeting Jan. 17, 1894, by Mr. Spencer Miller, associate member.

with sockets for wooden handles, by which it is guided. This bucket is dragged up the sand or gravel bank, filling itself, and is then conveyed to the dump. By this rigging 40 scoop loads of one foot each have been taken out of a bank, carried 300 ft. to 400 ft., and dumped in an hour's time.

The perfected and improved cable carriages recommended are shown in figs. 1 and 2. Fig. 1 is the Harris-Miller carriage for inclined cableways, and travels down the cable by force of gravity until it engages a locking stop fastened to the supporting cable, similarly to the one at the right of the carriage. This locking device holds the carriage until the fall block is drawn up and its stem forced into the inverted funnel, shown in the cut, which stem releases the lock and permits the carriage to ascend or descend. When the cableway is horizontal, fall-rope carriers must be provided, and these are shown in connection with the Miller carriage shown in fig. 2. These fall-rope carriers are to prevent the hoisting rope from sagging, and are carried upon a horn or projecting hook on the front of the carriage, shown at the right of fig. 2, with one carrier detached at the right of carriage and one being carried upon the horn. These carriers are pulled off from the carriage at equal intervals by buttons of different sizes fastened to a button rope shown in the figure. The first carrier to come off has a small hole through which the button rope passes, and a small button that slips through the holes of the others engages it and pulls it off, the last carrier having the largest holes being pulled off by the largest button. The carriers are taken up by the carriage as it approaches the engine, and are taken off by the buttons as the carriage recedes from the engine. One of these buttons is shown in fig. 3.

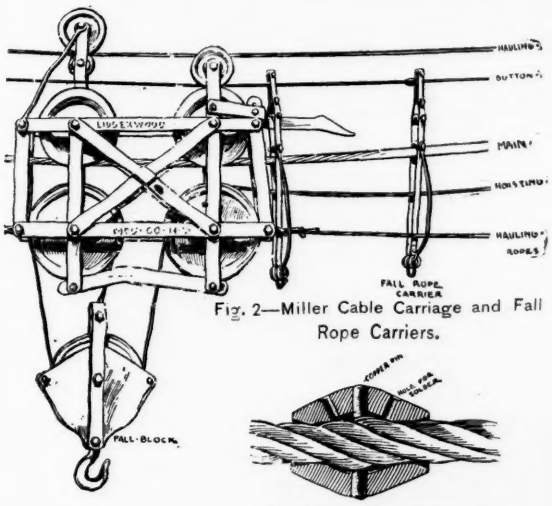


Fig. 2—Miller Cable Carriage and Fall Rope Carriers.

Fig. 3—The Button.

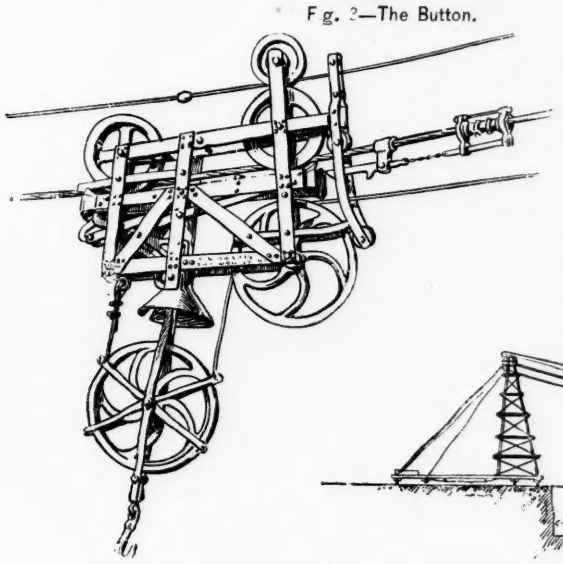


Fig. 1—Harris-Miller Carriage.

Mr. Miller gave some interesting statistics, which follow, together with some illustrations of certain jobs. One of the specially interesting pieces of work illustrated and described is that of the Austin dam. This cableway was 1,350 ft. span, stretching entirely across the stream, and was employed to carry materials from the banks, quarries, etc., to the dam and to deposit them near at hand for use. The cost of the entire plant for conveying and hoisting was about $9,000. This cableway moved as much as 180 cubic yards a day, a distance of 1,000 ft. It is now the custom to suspend two cableways over such work, which prevents the necessity of handling the stones and material twice and the use of derricks for that purpose.

The cableway at the Butte City water-works dam is suspended from two derricks, one 80 ft. high and the other 15 ft. high, and the cable is 900 ft. span. The size of the main cable is 2¼ in., and it has carried 6 tons. The cost of this plant entire was about $7,500 erected. The stones were quarried and the concrete mixed in the line of the cable, and raised and transported by the cable appliances. It is said to be the first instance on record where the stone were quarried under the line of the cableway and then conveyed and set directly in the dam with no handling. Such a plant for handling and transporting material effects a wonderful saving in the cost of construction work.

Fig. 4 shows a modern and ingenious device for excavating the main drainage canal of Chicago. The derricks are placed upon platform cars together with the hoisting machinery and counterweights. The span is 623 ft. and the towers 80 ft. high, the main cable 2 in. and the weight carried 6 tons. The cars are 102 ft. long, on 54 wheels and are moved by a special winding apparatus or by motors attached directly to the wheels. The cost of this plant is put at $14,000, including the cars, derricks and everything. The cars have been moved at the rate of 5 ft. a minute and material moved at the rate of 453 yds. a day, and by recent improvements this capacity has been increased to 500 yds. The record of this cableway on wheels, at the Main Drainage Canal, is 37 skip loads of 2⅛ cu. yds. each, in one hour, with 30 men in the breast. If this rate was maintained for a day of 10 hours it would give 786 cu. yds. per day of material removed and carried to the spoil bank. Another record made is 268 skip loads of 2⅛ yds. each per day, a total capacity of 572 yds. or 1,144 tons; 500 yds. a day is given as the average. Reducing these figures to cents per yard it gives for hoisting from the ditch and conveying to the spoil bank a price of about 4 cents a cubic yard, and if the original cost of plant and the cost of operation both be considered it increases the cost of removing such rock to 8 cents a cubic yard. These prices do not include the blasting or loading of the skips, but only the work performed by the cableway.

Another interesting use of cableways is that employed in logging. This was illustrated by lantern views representing the cable attached to two trees, which are securely guyed, and the engine installed at one end and the skidding and snaking of logs to the mill or railroad track, where they are loaded and shipped. The cable employed in this work is usually about 700 ft. span, and a large territory is covered by changing the tail end of the cable to some other tree, keeping the head of the cable at the same place. By this method an area of 1,400 ft. in diameter can be cleared and skidded in an incredibly short time. By unhitching the tail end of the cable and employing the hoisting rope itself to haul it in and then a block and pulley to drag it out again and to raise it in place the cable can be taken down and re-erected at another place in a very short time. The total cost of such a plant is but $4,500.

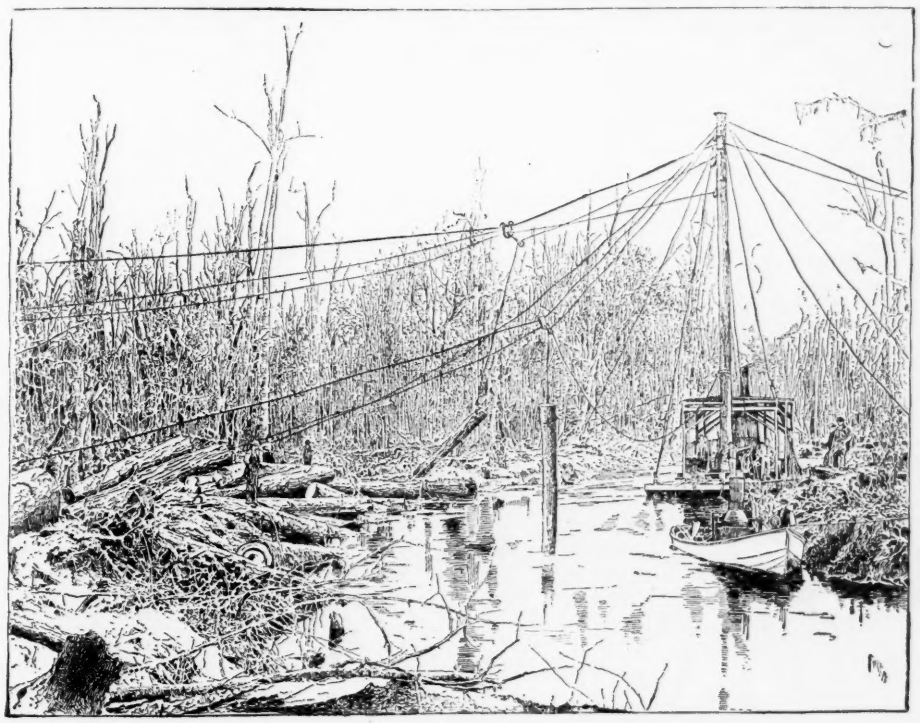


Fig. 5—Cableways in Cypress Logging.

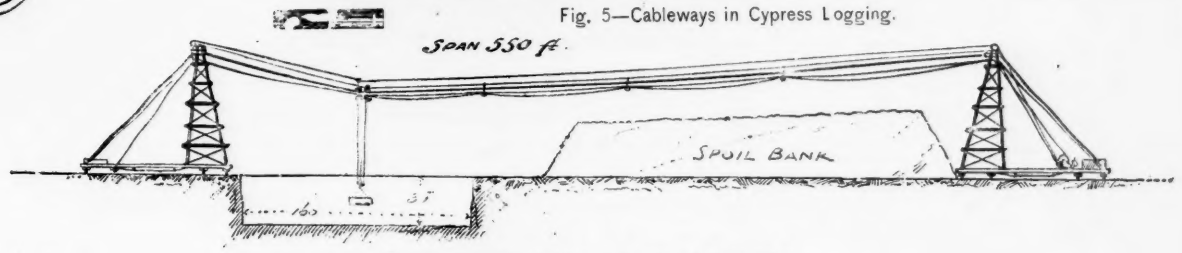


Fig. 4—Portable Cableway for Canal Excavation.

CABLEWAYS FOR HOISTING AND CONVEYING.

Fig. 5 shows the adaptation of the cableway to logging in cypress swamps of the South. It shows the mast of a scow as the head derrick. The logs are snaked to the stream, unhitched and floated to the mill. By the use of the cableway cypress logs may be skidded on board cars or delivered in the stream for $1.10 per M. ft. board measure, and pine logging can be handled for 50 cents per M. ft. board measure. In fig. 5 the scow is about 50 ft. long × 14 ft. wide, draws 2 ft. of water, and stands 18 in. out of water. The mast is about 45 ft. high and 18 in. diameter at the butt. Logs weighing 12,000 lbs. are easily handled with this device. The average daily capacity of a cableway skidding outfit is 70,000 ft. at a total cost of $31.75; and repairs may be estimated at about 10 cents per thousand.

Mr. Miller did not mention the possibility of the use of cableways as a means of rapid-transit, but when cableways may be stretched for over a thousand feet and a load of five to six tons carried safely and securely it becomes but a question of time when the cableway will become a way of cheap transportation through very mountainous countries. With the trolley sytem of motive power and proper design of a carriage there seems no good reason why this system of transportation should not be adopted where the construction of tramways is too expensive. This, it would seem, presents a good field for development and Mr. Miller with his experience and knowledge of the subject should be the proper one to discuss and develop it.

Interstate Commerce Investigation at Chicago.

The investigation before the Federal Grand Jury at Chicago concerning alleged violations of the Interstate Commerce law was resumed on Thursday of last week. The witnesses declined to testify on the ground that their testimony would either criminate themselves directly or furnish evidence which might be used to institute other and subsequent proceedings which would eventually so criminate them. President Newell, of the Lake Shore, and Chairman Blanchard, of the Central Traffic Association, were examined before the jury briefly and were excused from further examination. General Freight Agent J. G. James, of the Lake Shore, was then called. After a few preliminary questions he was asked: "What do you know of the shipments of dairy products from Chicago to points east of Illinois during May and June, 1893, at a less freight rate than was named in the tariff then in force?" To this question the witness declined to answer, stating his reasons for declining as follows:

"I refuse to answer the question now propounded to me for the reasons, first, the answer to said question would tend to criminate me personally, and in this refusal to answer I claim the protection of the fourth and fifth amendments to the constitution of the United States; second, the answer to the question would be a disclosure of evidence criminating and tending to criminate me personally under the provisions of the law of the United States commonly known as the interstate commerce law, and which would or might be made use of in a criminal prosecution against me for violation of said law; third, I respectfully deny the jurisdiction and authority of the grand jury to demand my attendance before it, or being present to examine me as a witness in the pending investigation."

The witness subsequently being asked to state what he knew regarding the cutting of rates by the Pennsylvania and Grand Trunk refused to answer for the second and third reasons as stated in his answer to the previous question. Gordon McLeod, General Western Agent of the Merchants' Despatch, was then called, but declined to answer questions propounded for the same reasons as given by Mr. James. A. T. Packard, railroad reporter of the Chicago *Herald*, was also called and testified as to the interview with President Newell which has been so widely published. On Friday the grand jury made a return to Judge Crosscup of the testimony of Messrs. James and McLeod, and a rule was issued upon them, returnable Feb. 19, to appear and show cause why they should not testify. The grand jury was then excused for a week.

Messrs. James and McLeod appeared before the court on Monday, accompanied by their counsel. The opening argument for the respondents was made by Aldace F. Walker, in substance as follows:

The proceedings are said to relate to alleged violations of the Interstate Commerce Law, but the questions to be presented do not specially concern that law or its administration. They are matters affecting the rights

of citizens under the constitutional provision that no person shall be compelled to be a witness against himself in any criminal case. The question might arise as well in reference to the alleged violation of any other law as of this. The constitutional right is absolute. The constitution does not say "no person shall be compelled in any criminal case to be a witness against himself," except in cases where he cannot be punished, but it says "he shall not be compelled to be a witness against himself" at all. He shall *not* be compelled. Congress undertakes to say that he *shall* be so compelled, in a specified case, when it will not subject him to punishment. Congress cannot rescind the constitution as to specified cases. In the Counselman case it was held that "it would be quite another thing if the constitution had provided that no person shall be compelled . . . unless it shall be provided by statute, etc. A mere act of Congress cannot amend the constitution, even if it should engraft thereon such a proviso."

The part of the opinion in the Counselman case in which it is held that Section 860 of the Revised Statutes did not help out the effort of the government to compel Mr. Counselman to testify, does not in any way detract from the force of the above quoted language.

The act of Feb. 11, 1893, does not accomplish the end apparently intended by its framers. Presumably it was intended to give complete immunity, having the same scope and effect as the constitutional provision itself. But it does not purport to *compel* the witness to testify. It only says that "no person shall be excused," etc. It does not imply the word "court" at all. The whole act seems rather to refer to causes and proceedings before the Interstate Commerce Commission than before the courts.

It does not protect against clues to evidence concerning other transactions which may be disclosed by his testimony, or against the possibility that he will wittingly or unwittingly make known "sources of information which may supply other means of convicting him" for other like matters. If, however, the immunity be absolute and complete it is then nothing but a pardon; and a legislative pardon is itself wholly unconstitutional.

Therefore either the immunity is not complete, in which case it is useless, or it is complete, in which case it is void.

The Vertical Influence of the Counterbalance.[1]

BY R. A. PARKE, M. E. AND C. E.

Some experiments at Purdue University have attracted considerable attention as reported in the *Railroad Gazette* of Dec. 15, 1893. They consisted in passing annealed iron wires between the revolviug driver and the wheel upon which the driver rests, instead of upon a stationary track. The experiments seem to indicate that the driver was lifted from the rail when revolving at ordinary speeds, and it is the purpose of this paper to investigate the conditions which might produce such a result, and to indicate the actual vertical lift of the driver under various conditions.

There are four necessary and distinct considerations in determining the counterbalance of locomotive driving wheels:

First, the wheel itself, including the crank and crank pin, must be balanced by a certain weight of counterpoise.

Second, the weight of the parallel rod or rods which the crank-pin carries requires a certain additional weight in the counterpoise.

Third, the counterpoise of the main driving wheel should have a certain additional weight to balance the

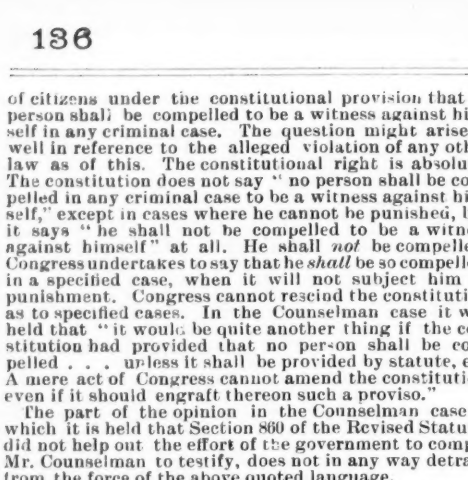


Fig. 1.

influence of the main rod and reciprocating parts, when the crank pin is vertically above or below the center of the wheel.

Fourth, a certain additional weight should be distributed among the counterpoises of the different driving wheels, to more nearly secure horizontal balancing of the main rod and reciprocating parts.

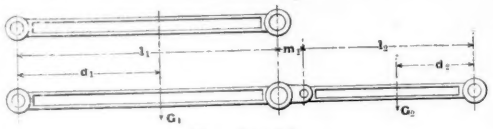
The matter will be considered in the order of these subdivisions.

To balance the wheel as a whole, it is necessary that the weight of the counterpoise, together with that of the remaining portion of the spokes *e* and *f*, shall balance the weight of the crank and crank pin and that of the portions of the spokes and rim included within the dotted sector corresponding to the counterpoise, fig. 1. In order to determine the weight of the counterpoise, necessary to produce a balance of the wheel, it is necessary to calculate the weight of the parts and their distance from the centers of gravity from the center *O*.

If W' = the weight of counterpoise necessary to balance the wheel, and c = the distance of its center of gravity in feet from the center *O*, then $W'\ c$ = the summation of the products of the weight of each part by the distance in feet of its center of gravity from *O*. The methods of finding the center of gravity of the parts named is then described, and the distance of each from the center of wheel *O*.

The additional weight of counterpoise to balance the weight of the parallel rod is determined as follows, fig. 2: If r = the radius of the crank circle, in feet, P = the weight of the parallel rod borne by the crank pin, and W'' = the weight of counterpoise necessary to balance the parallel rod, then $W''\ c = P\ r$. The weight P will be different, of course, in different cases. If there are two pairs of drivers connected, and the parallel rod has the same shape and dimensions at the two ends, $P = \frac{1}{2}$ the weight of the rod complete.

If, however, the two ends of the rod are not alike, let l_1 = length of rod from center to center of crank pin, let d_1 = the distance of the center of gravity of the rod from the center of the crank pin of the rear driver, and let G_1 = the weight of the rod complete.



Figs. 2 and 3.

Then for the rear driver, For the forward driver,

$$P_1 = \frac{l_1 - d_1}{l_1} G_1 \qquad P_2 = \frac{d_1}{l_1} G_1$$

In the case of a mogul or 10-wheel engine, as shown in fig. 3, let m_1 = the distance from the center of the crank pin of the middle driver to the center of the pin connecting the two sections of the parallel rod. Then for the rear driver,

$$P_1 = \frac{l_1 - d_1}{l_1} G_1 - \frac{m_1}{l_1}\frac{d_2}{l_2} G_2.$$

For the middle driver,

$$P_2 = \frac{d_1}{l_1} G_1 + \frac{m_1 + l_1}{l_1}\frac{d_2}{l_2} G_2.$$

For the forward drive,

$$P_3 = \frac{l_2 - d_2}{l_2} G_2.$$

For a consolidation engine, the valves of P for the different drivers were also given.

Thus far the problem has been simply one of mechanical leverages and weights. The effect of the weight and motion of the main connecting rod and reciprocating parts upon the main driver is a much more complicated matter. In fig. 4, *O* is the center of the driver, *C* is the center of the wrist-pin, r = radius of crank circle in feet, and l = length of main connecting rod in feet. The end of the rod at *C* has a reciprocating horizontal motion, while the other end moves in a circle with the crank pin. The motion of the rod may, therefore, be separated into two component motions—one, a motion of horizontal translation, and the other, an oscillating or pendulum-like motion about the center *C*. The crank pin revolves with a uniform angular velocity ω. The crank pin exerts a pressure or force upon the rod, in some direction, at each instant This variable force may be resolved into two components, one, N, normal to the crank circle and pointing toward or away from the center, *O*; the other, T, tangential to the crank-circle or at a right angle with the normal. The reciprocating parts (piston, piston-rod, cross-head, and cross-head pin) exert a force, R, upon the end of the rod at *C*, in a horizontal direction, and the guides react upon the same end of the rod in a vertical force, V. The weight of the rod, W_c, is also a force acting downward through the center of gravity of the rod. At any instant, the crank will stand at some angle, α, with the horizontal center line, *O C*, and the connecting-rod will be at some angle, φ, with the line *O C*. The direction of each of the forces, N, T, R, V, and W_c, is known though the amount of each, except W_c, or whether it is positive or negative, is unknown.

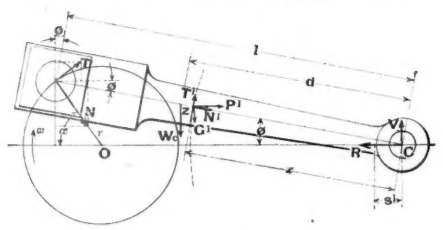


Fig. 4.

By applying these forces to the rod, if the friction of the pins be neglected, the rod may be considered a free body, and through the action of these forces the rod will move in exactly the same way as actually occurs. At any instant a particle z at any point in the rod may be regarded as being acted upon by four forces, as follows: A horizontal force, P', to cause its motion of translation; a tangential force, T', giving the particle its oscillatory movement; a normal or centripetal force, N', restraining the particle from deviating from its oscillatory path, and the force, G' of gravity, acting vertically downward. Equating the conditions of equilibrium for a free body,

$$T' \cos\alpha - N' \sin\alpha - W_c + V = \int T' \cos\varphi - \int N' \sin\varphi - \int G'. \qquad (1)$$

$$T' \sin\alpha - N' \cos\alpha + R = -\int T' \sin\varphi - \int N' \cos\varphi - \int P'. \qquad (2)$$

$$T' l \cos(\alpha - \varphi) - N' l \sin(\alpha - \varphi) - W_c\ d \cos\varphi = \int T' x + \int P' x \sin\varphi - \int G' x \cos\varphi. \qquad (3)$$

The particle z moves in its oscillation about the center *C*, with a variable angular velocity ω', and has a variable angular acceleration θ'. It also moves in the direction of its motion of translation, with a variable velocity v' and has a variable acceleration p'. The piston and cross-head also move with the variable velocity of translation v', and have the variable acceleration p'. If the mass of the connecting-rod be represented by M_1, and that of the piston, piston-rod and cross-head by M_2, equations (2) and (3) may be written, since

$$N' = d\ M_1 \frac{\omega'^2 x^2}{x},\ T' = d\ M_1\ \theta'\ x \text{ and } P' = d\ M_1\ p',$$

$$T \sin\alpha + N \cos\alpha - M_2\ p' = \int d\ M_1\ \theta'\ x \sin\varphi + \int d\ M_1\ \omega'^2\ x \cos\varphi + \int d\ M_1\ p.$$

$$T\ l \cos(\alpha - \varphi) - N\ l \sin(\alpha - \varphi) - W_c\ d \cos\varphi = \int d M_1\ \theta'\ x^2 + \int d M_1\ p'\ x \sin\varphi - \int d W_c\ x \cos\varphi.$$

Performing the integrations, and remembering that, for the instant, all particles of the rod have the same angular velocity and angular acceleration and the same velocity and acceleration of translation,

$$T \sin\alpha + N \cos\alpha - M_2\ p' = M_1\ \theta'\ d \sin\varphi + M_1 \omega'^2\ d \cos\varphi + M_1\ p'$$

$$T\ l \cos(\alpha - \varphi) - N\ l \sin(\alpha - \varphi) - W_c\ d \cos\varphi = M_1\ \theta'\ k^2 + M_1\ p'\ d \sin\varphi - W_c\ d \cos\varphi,$$

where k = the radius of gyration about the center *C*.

Eliminating T from these two equations, the value of N, the normal force applied by the crank-pin to the connecting-rod, becomes

$$N = M_1 \left\{ \theta'\ d \frac{\sin\alpha \cos(\alpha - \varphi)}{\cos\varphi} + \omega'^2\ d \cos(\alpha - \varphi) - \frac{\theta'\ k^2 \sin\alpha}{l \cos\varphi} - \frac{p'\ d \sin\alpha \sin\varphi}{l \cos\varphi} \right\} + (M_1 + M_2) \frac{p' \cos(\alpha - \varphi)}{\cos\varphi}. \qquad (4)$$

It now remains to supply, in this value of N, the proper values of ω', θ' and p'. By the well known differential equations for velocity, acceleration and space the values found are as follows:*

$$\omega' = \frac{r \cos\alpha}{l \cos\varphi}\ \omega.$$

$$\theta' = \frac{r\ \omega^2}{l}\left(\frac{r \sin\varphi \cos^2\alpha}{l \cos^3\varphi} - \frac{\sin\alpha}{\cos\varphi}\right) \text{ and}$$

$$p' = r\ \omega^2 \left(\cos\alpha - \frac{r \cos^2\alpha}{l \cos^3\varphi} + \frac{\sin\alpha \sin\varphi}{\cos\varphi}\right)$$

remembering that the horizontal distance traveled by the piston and connecting-rod, independent of the oscillating motion, is

$$s' = l \cos\varphi - r \cos\alpha + r - l.$$

Without attempting to complicate equation (4) by the substitution of these values of ω', θ' and p', which is wholly unnecessary for the present purposes, it is only necessary to find the values of N from equation (4), when $\alpha = 90°$ and when $\alpha = -90°$, for vertical balancing, and when $\alpha = o$ and when $\alpha = 180°$, for horizontal balancing.

Then

$$N = M_1\ \omega^2\ r \frac{r^2 + k^2 - r\ d\left(1 + \frac{r}{l}\right)}{l^2 - r^2} + M_2\ \omega^2\ r \frac{r^2}{l^2 - r^2}$$

value of N when crank is over axle: and

$$N = M_1\ \omega^2\ r \frac{r^2 + k^2 - r\ d\left(1 + \frac{r}{l}\right)}{l^2 - r^2} + M_2\ \omega^2\ r \frac{r^2}{l^2 - r^2}$$

value of N when crank is below the axle.

The force N is applied by the crank-pin to the connecting rod, as a centripetal force, to prevent it from flying away from the center of the driver, and there should be a certain weight, W''', of the counterpoise of the main driver for vertical balancing of the reacting outward or centrifugal force of the connecting rod upon the crank-pin. The centrifugal force of this weight of counterpoise is $\frac{W'''\ \omega^2\ c}{g}$, which must equal N. Since, also, $M_1 = \frac{W_c}{g}$ and $M_2 = \frac{W_p}{g}$ (where W_c = weight of connecting rod, W_p = weight of piston, piston rod and crosshead, and g = the acceleration of gravity), equating these quantities and solving,

$$W'''\ c = W_c\ r \frac{r^2 + k^2 - r\ d\left(1 + \frac{r}{l}\right)}{l^2 - r^2} + W_p \frac{r^2}{l^2 - r^2}. \qquad (5)$$

All the conditions of perfect vertical balancing of a locomotive are now defined.

It still remains to find the conditions of horizontal balancing of the main rod and reciprocating parts. In equation (4), make $\alpha = O$; then φ also $= O$, and it will be found that

$$N = M_1 \frac{\omega^2\ r^2}{l_2} d + (M_1 + M_2)\ \omega^2\ r \frac{l - r}{l}.$$

Also, in equation (4), make $\alpha = 180$ deg., then $\varphi = O$ and

$$N = (M_1 + M_2)\ \omega^2\ r \frac{l + r}{l} - M_1 \frac{\omega^2\ r^2}{l^2} d.$$

These horizontal values of N *are not equal*, and it is at once apparent that, if a counterpoise be used which will balance the main rod and reciprocating parts at one end of the stroke, these parts will not be balanced at the other end of the stroke. A locomotive cannot therefore be horizontally balanced for any speed whatever. The nearest approach to horizontal balancing will be attained by balancing for the mean of the two horizontal values of N, above found.

This mean value is $N = (M_1 + M_2)\ \omega^2\ r$. But a certain portion of this force has already been provided for by a weight W''', in the counterpoise of the main driver, which balances the vertical value of N. For the most nearly perfect horizontal balancing, therefore, a counterpoise must still be provided for the difference between the mean horizontal value of the force N and this vertical value of N. Let this difference Q. Some persons favor full balancing for the horizontal force Q, while others favor balancing for only a portion of such horizontal force. Let it be assumed therefore that a certain percentage, m, of the force Q will be balanced. Let $W\varepsilon$ = the weight of counterpoise necessary to balance such a percentage of Q. Then

$$W\varepsilon\ c = m\ W_c\ r \frac{l^2 - 2r^2 - k^2 + r\ d\left(1 + \frac{r}{l}\right)}{l^2 - r^2} + m\ W_p\ r \frac{l^2 - 2r^2}{l^2}. \qquad (7)$$

[1] An abstract of a paper read before the New York Railroad Club, Feb. 15, 1894.

* These mathematical operations are carried out in full in the paper.

Of course $m = 1$ the weight $W\varepsilon$ is to fully balance Q. The rational manner of distributing the weight $W\varepsilon$ so as to cause the least vertical disturbance is to so divide it among the counterpoises of all the drivers. In other words $W\varepsilon\ c$ of equation (7) should be divided by the number of pairs of drivers, and the weight of counterpoise added to each wheel for horizontal balancing.

In equations (5) and (8) for finding the weights W''' and $W\varepsilon$ for vertical and horizontal balancing of the reciprocating parts, no material error will arise from giving to k^2 the value $\frac{1}{2}\ l^2$. It will also be found that d, the distance of the center of gravity from the center of the wrist-pin, will not be far from $\frac{3}{8}\ l$. Substituting these values of k^2 and d in equations (5) and (8), equation (5) becomes

$$W'''\ c = W_c\ r\ \frac{\frac{3}{8}\ r^2 + \frac{1}{2}\ l^2 - \frac{5}{8}\ r\ l}{l^2 - r^2} + W_p\ r\ \frac{r^2}{l^2 - r^2}, \quad (9)$$

and equation (8) becomes

$$W\varepsilon_1\ c_1 = W\varepsilon_1\ W'\ c_1 = \text{etc.}, =$$

$$m\ r\ \left\{ \frac{W_c\ (\frac{1}{2}\ l^2 - \frac{11}{8}\ r^2 + \frac{5}{8}\ r\ l) + W_p\ (l^2 - 2\ r^2)}{(l^2 - r^2) \times \textit{No. of pairs of drivers}} \right\} \quad (10)$$

These equations are very simple of application and are entirely practicable.

The vertical disturbance produced by the weight of counterpoise added for securing partial or entire horizontal balancing is found for each driver from this equation. Examples were given and practical results deduced from these equations.

Data of a mogul engine substituted in these equations for speeds of 50 miles per hour gave the vertical effect of the counterbalance as follows: For the rear driver, 7,742 lbs.; for the main driver — 5,315 lbs.; for the rear driver, 10,323 lbs., with full horizontal balancing. In exactly $\frac{1}{10}$ of a second the pressure of the forward driver upon the rail varies over 10 tons, while that of the rear driver varies nearly 8 tons. The effect of these heavy strains on the locomotive frame is an element in the cost of repairs, and the conditions are very injurious to the track. There are locomotives all over the country balanced not only as bad as, but wore than, the one just considered.

The motion of the driving wheel, under the influence of an unbalanced vertical force, presents a very interesting study. It must be assumed, for the purposes of investigation, that the track and its support are either perfectly elastic or perfectly rigid. As a matter of fact, it is never the one nor the other. Still if it can be shown that the conditions causing the wheel to lift from the rail are practically the same in both cases, it may be taken that the same are true for intermediate degrees of elasticity. It will be understood that this investigation relates to any driver except the main driver, for a demonstration of the vertical action of the main driver would be hopelessly complex.

When the locomotive is at rest, let W = the total weight of driver on rail; let W_1 = the weight of the driver and attachments; let $W\varepsilon$ = excess of counterpoise over that necessary for vertical balancing; let c = the distance in feet of the center of gravity of the counterpoise from the center of the driver; let h_1 = the deflection in feet of the driver spring under normal load; let h_2 = the deflection in feet of the perfectly elastic track under the weight W. The conditions of rest are then shown in fig. 5. Now let the wheel rotate, with a constant angular velocity, ω.

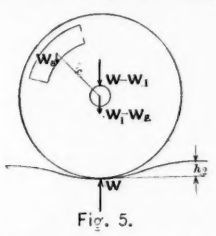


Fig. 5.

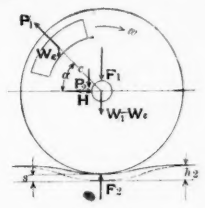


Fig. 6.

The conditions at any instant are represented in fig. 6. The driver may be considered a free body, as the forces are applied. At the instant, the driver has lifted a certain distance, s, above the position shown in fig. 5. The forces F_1, and F_2, therefore, become (on account of the elasticity of the spring and track),

$$F_1 = \frac{h_1 + s}{h_1}\ (W - W_1) = (1 + \frac{s}{h_1})\ (W - W_1) \text{ and}$$

$$F_2 = \frac{h_2 - s}{h_2}\ W = (1 - \frac{s}{h_2})\ W.$$

The algebraic sum of the internal forces, tending to lift the wheel, must equal the algebraic sum of the applied forces, opposing the upward motion of the wheel; that is,

$$P_1 \sin\alpha - P_2 = F_1 + (W_1 - W\varepsilon) + W\varepsilon - F_2 = F_1 + W_1 - F_2. \quad (11)$$

If p = the acceleration of the force P_2, then, giving the forces in equation (11) their proper values and solving,

$$\frac{W\varepsilon}{g}\ \omega^2\ c \sin\alpha - \frac{W_1}{g}\ p = s\left(\frac{W - W_1}{h_1} + \frac{W}{h_2}\right). \quad (12)$$

That is, the resistance to the vertical motion of the wheel is proportional to the distance, s, which the wheel moves up or down from its position when at rest. Also, the counterpoise has a horizontal vibration of $2c$ in a certain period of time, and a vertical vibration of $2\ (c + s_1)$ in the same period of time. The path of the center of gravity of the counterpoise, with reference to the moving locomotive, is therefore an ellipse.

The path of the counterpoise is illustrated in fig. 7.

By the substitution of the value of p, equation (12) becomes equation (14) or

$$\frac{W\varepsilon}{g}\ \omega^2\ c \sin\ \alpha + \frac{W_1}{g}\ \omega^2\ s_1 \sin\alpha = s\left(\frac{W - W_1}{h_1} + \frac{W}{h_2}\right).$$

When $\alpha = 90$ deg., $\sin\ \alpha = 1$ and $s = s_1$. Applying these values in equation (14) and solving for s_1, it will be found that

$$s_1 = \frac{W\varepsilon\ \omega^2\ c\ h_1\ h_2}{W\ g\ (h_1 + h_2) - W_1\ h_2\ (g + \omega^2\ h_1)}. \quad (15)$$

Substituting this value of s_1 in equation (13) or equation (14),

$$s = \frac{W\varepsilon\ \omega^2\ c\ h_1\ h_2 \sin\alpha}{W\ g\ (h_1 + h_2) - W_1\ h_2\ (g + \omega^2\ h_1)}.$$

From this equation, the height, s, of the rise of the wheel can be found for any angle, α. In equation (15) the height s_1 is the greatest rise of the wheel. This value of s_1 is only true, however, when the wheel does not leave the rail, or when s_1 is not greater than h_2. If $s = h_2$, $F_2 = O$, and, as the rail is not secured to the wheel so as to be lifted by it, a negative value of F_2 cannot exist. Therefore, when s is greater than h_2 the relation between the vertical forces, expressed in equation (11), becomes

$$P_1 \sin\alpha - P_2 = F + W, \quad (16)$$

and equation (12) becomes

$$\frac{W\varepsilon}{g}\ \omega^2 c \sin\alpha^2 - \frac{W_1}{g}\ p - W = \frac{W - W_1}{h_1}\ s. \quad (17)$$

Fig. 8 shows the elliptical path of the counterpoise after the wheel leaves the rail. The greatest rise of the center of the driver, from the center of the original ellipse, may be designated by s_2. It will be found that the center of the second ellipse is below that of the original, and the vertical distance below may be represented by a. Then from the new ellipse,

$$(c + a + s_2) \sin\alpha = c \sin\alpha + a + s,$$

and

$$a + s = (a + s_2) \sin\alpha. \quad (18)$$

Also, from equation (17),

$$p = \frac{W\varepsilon}{W_1}\ \omega^2\ c \sin\alpha - \frac{W}{W_1} g - \frac{W - W_1}{W_1\ h_1}\ gs.$$

Substituting this value of p in the well-known differential equation, $p\ ds = v\ dv$, and noting that, from equation (18),

$$ds = (a + s_2) \cos\alpha\ d\alpha,$$

integrating and reducing,

$$\frac{W\varepsilon}{W_1}\ \omega^2\ c\ (a + s_2)\frac{1 - \sin^2\alpha}{2} - \frac{W}{W_1}\ g\ (s_2 - h_2) - \frac{W - W_1}{W_1\ h_1}\ g\ \frac{s_2^2 - h_2^2}{2} = -\frac{v^2}{2}. \quad (19)$$

Combining equations (19), (18), (13), and substituting the values of

$$v^2 = \omega^2\ s_1^2 \cos^2\alpha = \omega^2\ s_1^2\ (1 - \sin^2\alpha) = \omega^2\ (s_1^2 - h_2^2)$$

$$W\varepsilon\ \omega^2\ c\ \frac{h_1}{s_1}\ (s_2 - h_2)\ (s_1 + h_2) - 2\ W\ g\ h_1\ (s_2 - h_2) - (W - W_1)\ g\ (s_2^2 - h_2^2) = -\ W_1\ \omega^2\ h_1\ (s_1^2 - h_2^2),$$

or,

$$s_2^2 - \frac{W_e\ \omega^2\ c h_1 + (W - W_1)\ g\ h_2 - W\ g\ h_1 - W_1\ \omega^2\ h_1\ h_2}{(W - W_1)\ g}\ s_2 = \frac{W_1\ \omega^2\ h_1\ s_1^2 - W\varepsilon\ \omega^2\ c\ h_1\ h_2 + W\ g\ h_1\ h_2}{(W - W_1)\ g}. \quad (20)$$

This equation, formidable as it appears, may be solved for s_2 by giving s_1^2 its value from equation (15), and the actual lift, $s_2 - h_2$, may be found, for different unbalanced weights $W\varepsilon$, and different speeds or values of ω. If the weight, $W\varepsilon$ and angular velocity ω are such that the wheel does not lift from the rail, but is on the point of doing so, the pressure of the wheel upon the rail becoming O, then, in equation (15), by making $s_1 = h_2$, it is found that

$$W\varepsilon\ c = \frac{W\ g}{\omega^2} + (W - W_1)\ \frac{g}{\omega^2}\ \frac{h_2}{h_1} - W_1\ h_2, \quad (21)$$

or

$$W\varepsilon = \frac{W\ g}{\omega^2\ c} + (W - W_1)\ \frac{g}{\omega^2\ c}\ \frac{h_2}{h_1} - W_1\ \frac{h_2}{c};$$

which means that the value of $W\varepsilon$, to be found from this equation, is the greatest unbalanced weight in the counterpoise which can be employed at a given angular velocity without lifting the driver from the rail.

Where the roadbed may be considered rigid and the deflection due to the elasticity of the rail and the wheel tire may be regarded as practically O, the path of the center of gravity of the counterpoise, with reference to the moving locomotive, is normally a circle.

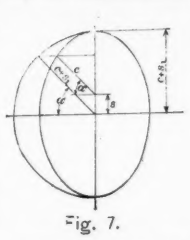


Fig. 7.

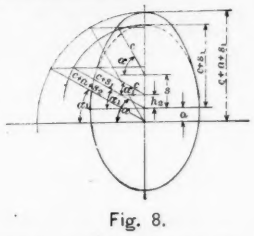


Fig. 8.

If the driver rises clear of the rail, at some angle, α', in fig. 9, the pressure between the wheel and rail will become O. Making $F_2 = O$ in equation (11), the relation between all the forces acting upon the wheel is

$$\frac{W\varepsilon}{g}\ w^2 c \sin\alpha - \frac{W_1}{g}\ p - W = \frac{W - W_1}{h_1}\ s. \quad (17)$$

This equation indicates an elliptical path of the counterpoise, similar to that last considered, and is shown in fig. 9.

By a mathematical treatment similar to that employed in the previous case,

$$\frac{W\varepsilon}{W_1}\ \omega^2\ c\ \sin\alpha\ ds - \frac{W}{W_1} g\ ds - \frac{W - W_1}{W_1}\ \frac{g}{h_1}\ s\ ds = v\ dv.$$

By substituting the value of ds and $d\alpha$ and integrating between the limits α and $\frac{\pi}{2}$, o and s_2 and O and o for v,

$$\frac{W\varepsilon}{W_1}\ w^2\ c\ (a + s_2)\ \frac{1 - \sin^2\alpha'}{2} - \frac{W}{W_1}\ g\ s_2 - \frac{W - W_1}{W_1}\ \frac{g}{h_1}\ \frac{s_2^2}{2} = O.$$

Eliminating α and α' and reducing,

$$(W\varepsilon\ w^2\ c + W\ g)\ s_2 - 2\ W\ g\ s_2 - (W - W_1)\ \frac{g\ s_2^2}{h_1} = O;$$

whence,

$$s_2 = \frac{W\varepsilon\ w^2\ c - W\ g}{(W - W_1)\ g}\ h_1. \text{ Giving } w^2 \text{ its value } 8.604\ \frac{S^2}{D^2},$$

S being the speed in miles per hour, and D being the diameter of wheel in feet; and giving g its value, 32.15,

$$s_2 = \frac{8.604\ W\varepsilon\ c\ S^2 - 32.15\ W\ D^2}{32\ 15\ (W - W_1)\ D^2}\ h_1. \quad (26)$$

The greatest lift of the driver, s_2, in feet, is easily found from this equation, for different unbalanced weights $W\varepsilon$ and different speeds S.

If $\alpha' = 90$ deg. in equation (22) or $s_2 = O$ in equation (25),

$$W\varepsilon\ c = \frac{W\ g}{\omega^2} = 3.736\ \frac{W\ D^2}{S^2}. \quad (26)$$

From this equation may be found the greatest unbalanced weight of counterpoise which can be used for a given speed without actually lifting the wheel from the rail.

It is interesting to compare this value of $W\varepsilon\ c$ with that found in equation (21), for an elastic track.

It is evident that a wheel is more easily lifted from a rigid than from an elastic track. But as h_1 is usually from .25 to .30 ft., while h_2 is probably not more than about .04 ft., and as W_1 is usually about .2 W, the moment $W\varepsilon\ c$ (or the weight $W\varepsilon$) for an elastic track would probably not exceed that for a rigid track, for a comparatively high-speed locomotive, by more than 10 per cent.

A similar comparison, for the height of lift of the driver from the rail, of equations (25) and (26), would doubtless indicate that, while a greater lift occurs in the case of a rigid track than with an elastic one, the difference will be comparatively slight.

For all practical purposes, therefore, it may be concluded that the results found for a rigid track are applicable to the conditions of actual service and may be used to determine the maximum proportion of the weight of the reciprocating parts and connecting rod to be used for horizontal balancing. It was found in equation (10) that for any single driver,

$$W\varepsilon\ c = m\ r\ \frac{W_c\ (\frac{1}{2}\ l^2 - \frac{11}{8}\ r^2 + \frac{5}{8}\ r\ l) + W_p\ (l^2 - 2\ r^2)}{n\ (l^2 - r^2)},$$

where m = percentage of full horizontal balancing to be used, and n = the number of pairs of drivers.

Also, from equation (26),

$$W\varepsilon\ c = \frac{W\ g}{\omega^2}.$$

By combining these equations,

$$m = \frac{W\ g\ n\ (l^2 - r^2)}{W_c\ \omega^2\ r\ (\frac{1}{2}\ l^2 - \frac{11}{8}\ r^2 + \frac{5}{8}\ r\ l) + W_p\ \omega^2\ r\ (l^2 - 2\ r^2)}.$$

This value of m is the greatest percentage of full horizontal balancing which can be used without lifting the drivers from the rail at any specified speed. Replacing ω^2 by its value,

$$8.604\ \frac{S^2}{D^2},$$

$$m = \frac{.1162\ W\ g\ D^2\ n\ (l^2 - r^2)}{W_c\ S^2\ r\ (\frac{1}{2}\ l^2 - \frac{11}{8}\ r^2 + \frac{5}{8}\ r\ l) + W_p\ S^2\ r\ (l^2 - 2\ r^2)}. \quad (27)$$

It is plain, from this value of m, that the weight which can be used toward securing horizontal balancing increases with the square of the diameter of the driver. For the same speed, a much smaller proportion of the weight, necessary for full horizontal balancing, can be used with small drivers than can be used with large drivers, without serious vertical disturbance. The extent to which horizontal balancing can be introduced also varies directly with the number of pairs of drivers, and inversely as the weight of the connecting rod and reciprocating parts and also inversely as the crank radius. It is interesting to apply the results of these investigations to some locomotives in service.

The data concerning the mogul freight locomotive, before used as an example, when substituted in the equations derived will show that for speeds above S = 60.3 miles per hour, the forward driver would rise from the rail.

If the speed be 65 miles, $s_2'' = 0.6$ in., and the angle during which it is free from the rail is $180° - 2\alpha' = 61°$.* Also the pressure upon the rail, due to the unbalanced weight when downward, is 17,450 lbs., and the total pressure of the wheel upon the rail, at that instant, is 32,450 lbs.

If the value of m be taken from equation (27), it will be found to be

$$m = 2{,}700 \div \text{speed.}^2$$

From this it is found also that if the full horizontal balancing weight could be distributed among the drivers, where $m = 1$, $S = 52$ miles per hour.

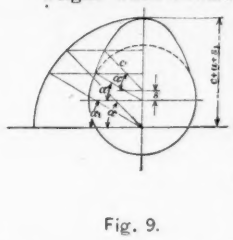


Fig. 9.

If $m = .50$, $S = 73.5$ miles.

Suppose the engine fully balanced horizontally; then,

$$s_2'' = .00135\ S^2 - 3.66, \text{ and } \sin\ \alpha' = \frac{2760}{S^2}.$$

At a speed of 55 miles, the lift of the driver is 0.42 in.; the angle while free from the rail is 54 deg.; the maximum pressure upon the rail is 31,800 lbs.

At a speed of 60 miles, the lift of the driver is 1.20 in.; the angle while free from the rail is 83 deg.; the maximum pressure upon the rail is 35,000 lbs.

At a speed of 65 miles, the lift of the driver is 2.04 in.; the angle while free from the rail is 101 deg.; the maximum pressure upon the rail is 38,470 lbs.

An example of a much more satisfactory design for balancing is a recent standard eight-wheel passenger locomotive, built by the Schenectady Locomotive Works. The actual distribution of the counterpoise weight is not known to the writer, but all the data for calculating it have been received and are given, as follows:

Weight which rear driver brings upon rail = W = 16,000 lbs.; weight of rear driver and supported parts = W_1 = 3,100 lbs; diameter of driver = D = 5 ft. 10 in; stroke = 24 in., or r = 1; length of connecting rod = l = 8 ft. 2½ in.; weight of connecting rod = W_c = 362 lbs.; weight of piston, piston-rod and cross-head = W_p = 532 lbs.; deflection of driving spring under normal load = h_1 = .271 ft., or 3¼ in.

From equation (27), $m = \frac{5233}{S^2}$.

The speed above which the driver would rise from the rail for full horizontal balancing is S = 72.3 miles. If m = .50, or the horizontal and vertical balancing are compromised evenly, S = 102.3 miles.

If the limit of speed is set, and m is taken accordingly

* Compare with corrected report of experiments at Purdue University in another column.

the results for different limited speeds are as follows: If $S = 75$, $m = .938$. If $S = 80$, $m = .817$. If $S = 90$, $m = .643$. The lift of the driver, for different values of m, may be found at different speeds from the equation, $s_2'' = .00077\ m\ S^2 - 4.03$, in inches. The angle at which the lift begins is found, from the equation, $\sin \alpha' = \frac{5233}{m\ S^2}$.

For full horizontal balancing (*i. e.*, when $m = 1$), the following results are found:

For a speed of 75 miles, lift of driver is 0.30 in.; angle while free is 43 deg.; maximum pressure on rail is 34,200 lbs.

For a speed of 80 miles, lift of driver is 0.90 in.; angle while free is 70 deg.; maximum pressure on rail is 35,570 lbs.

For a speed of 90 miles, lift of driver is 2.21 in.; angle while free is 100 deg.; maximum pressure on rail is 40,760 lbs.

It should be remembered that it has been assumed that the driving spring is perfectly elastic; that is, the deflection of the spring is proportional to the load. It is doubtful if this condition would be maintained for such extreme lifts of the driver as are above found for 90 and 100 miles.

It must also be remembered that these results are found for an *assumed* full horizontal balancing. It is very improbable that the locomotive is actually so balanced.

From these figures, however, in the cases of both locomotives, it is clearly indicated that, for locomotives of even the highest speed, there is no likelihood of a driver leaving the rail if any reasonable consideration is given to the matter of counterbalancing.

In conclusion, it should be pointed out that there is exclusively one method of locomotive design, which shall render both the horizontal and vertical disturbances a minimum. This is to reduce the weight of the reciprocating parts to a minimum.

The use of compound locomotives for high speeds, with the excessive weight of reciprocating parts customarily employed, must be accompanied by very serious wear and tear upon the roadway. It is very difficult to estimate such damage; but it is believed by the writer that if the actual cost to railroads of repairs and renewals of all kinds arising from this one source of damage could be ascertained, it would be found that the use of steel for pistons and crossheads would be abundantly justified for all high-speed locomotives, and that, very possibly, the expense due to the use of hollow steel piston rods and of aluminum pistons and crossheads would also be justifiable for high-speed compound locomotives.

DISCUSSION.

A unanimous vote of thanks was given to Mr. Parke for the excellent paper presented. The discussion was opened by Professor Goss, of Purdue University, who described and explained the experiments conducted with the locomotive at that University. He corrected some mistakes heretofore made in published reports of those tests, one of which was that the wheels rose from the wheel bearings at speeds of 40 or 50 miles. He stated that the speed at which the wheel lifted from the track was 59 miles an hour. Professor Goss, by diagrams on the blackboard, showed the shape of the wire after it came out from between the driver and its bearings. It was thin at one end, gradually growing thicker and less flattened until the full diameter of the wire was reached; and then, on the second part, the descent was very sudden, showing, as he surmised, that the wheel descended much more rapidly than it rose. Professor Goss also mentioned another interesting feature of these experiments, as follows: Upon the counterweighted side of the wheel a nick had been made with a cold chisel, so that it would show what part of the wire was passed over by a certain part of the wheel. In some of the wires it was noted that there were two projections about one-eighth or one-quarter of an inch apart, caused by this nick, indicating that the wheel had a slight vertical vibration, even when the counterpoise was down, causing the wheel to jump slightly and for the wire to pass under it a very short distance and make two impressions. This did not hold for all wires, but was noticed upon a few. Professor Goss explained that the locomotive in the Purdue University had been fully counterbalanced for reciprocating parts, because it was necessary in order to keep the engine steady or in place, and he called attention to the perfection of the horizontal counterbalancing.

Mr. STRONG gave the impression that he considered locomotives usually underbalanced; that locomotive designers and builders did not have to please the civil engineering department but the motive power department, and that they built locomotives to ride easily and without much reference to their effect upon the track. He mentioned an instance in which a locomotive was counterbalanced for two-thirds of the reciprocating parts, and that it rode so unevenly that the trunks walked about the baggage car. This was remedied by adding several hundred pounds of counterbalancing to the wheels, which probably nearly neutralized the effect of the reciprocating parts. Mr. Strong criticised Mr. Parke's paper as not being a mathematical demonstration of a perfect counterbalance, which he considered impossible; he thought that counterbalancing should be placed at same distance from center of wheel as the crank pin was from the center.

Mr. DIXON expressed himself by stating that usually manufacturers of locomotives had not to cater to the engineering department but to the master mechanics, and that it was their aim more to please the men within the engine and these who ordered them; which required them to make a smooth-riding locomotive rather than to produce a locomotive that had the least destructive effect upon track.

Mr. SINCLAIR complimented the paper and said that he considered it of great importance, but that the paper was so deeply mathematical that members should have time to give it some study before undertaking a discussion of it.

Mr. PARKE explained particularly that he had not sought to offer to the club a perfect counterbalance for a locomotive; that a locomotive could not be perfectly counterbalanced horizontally; that the two conditions at the opposite ends of the cylinders were different, and that although it could be perfectly balanced vertically, it could not under the present conditions be balanced horizontally; that he had not endeavored to show a perfectly counterbalanced engine, but had sought to show that such a thing was *impossible*.

Mr. WEST remarked that he had noted a great difference in the stability of a locomotive depending upon whether it was using steam, and at what pressure; that engines comparatively well balanced when working with steam were unbalanced when the reversing lever was up or the steam cut off. He asked Professor Goss about the steam pressure used on the Purdue locomotive, which the Professor said was about 140 lbs.

Mr. WAIT made some criticisms of the mathematics of the paper and expressed some doubt as to the equality of the normal forces (N), when the crank pin was directly over and directly under the center of the wheel, that at the upper point the crank was pulling, while at the lower point it was pushing, and that the mathematical operations as there applied did not consider the opposite tendencies of the steam when the crank was in the two positions, and that he would expect the normal forces for the two positions to be different. He criticised the diagrams, figs. 5 and 6, in that they were not free bodies as they should be, before applying the mathematical operations to derive the equations used; that while the engine was working the frame exercised a horizontal force upon the center of the wheel, the connecting rod a horizontal force upon the crank pin, and the track a horizontal, or nearly horizontal, force upon the tread of the wheel which rests upon the rail; that to have the conditions strictly correct, these forces should have been put in. He asked if Mr. Parke applied the usual formula for centrifugal force in terms of the distance between the center of the wheel and its center of gravity, and if he had obtained the same results; if the tendency which a wheel has to revolve upon its center of gravity had been investigated, and if Mr. Parke considered the restraints of the driving box sufficient to compel the drivers to revolve about its geometric axis. He also expressed regret that in investigating the lifting effect, the problem had not been considered as if the engine were rolling upon the track and the path of the counterweight taken as a trochoid with reference to the track, instead of as a circle with reference to the engine; that it was contended by many very intelligent people that the conditions were entirely different when the engine was running on the track from what they were with the engine jacked up or on rollers, as at the Purdue University.

Mr. PARKE, in reply to the inquiries made in the discussion, said that he had not hoped to show the effect of counterbalancing, taking into consideration the action of the steam upon the connecting rod; that if that were taken into consideration the normal component (N) or lifting power would be greater or less, depending upon whether the engine was going forward or backward. He stated that he had employed the general formula for centrifugal force in his investigations, and that the results were the same as obtained by the method which he had presented. He also explained that he had made a partial investigation of the vertical influence of counterweights according to the laws of the trochoid or prolate cycloid, and so far as his investigation had gone, he had obtained the same results as when treating it with reference to the engine, and that it was his conviction that it made no difference. He had not treated the subject under the impression that the wheel would revolve about its center of gravity, or even have a tendency to do so; that the idea that a pulley upon a shaft, having a tendency to revolve about the center of gravity of the pulley, he considered an erroneous one; that if the pulley was unbalanced it would have a tendency to draw the shaft in the direction of the heaviest side of the wheel, even at high velocities.

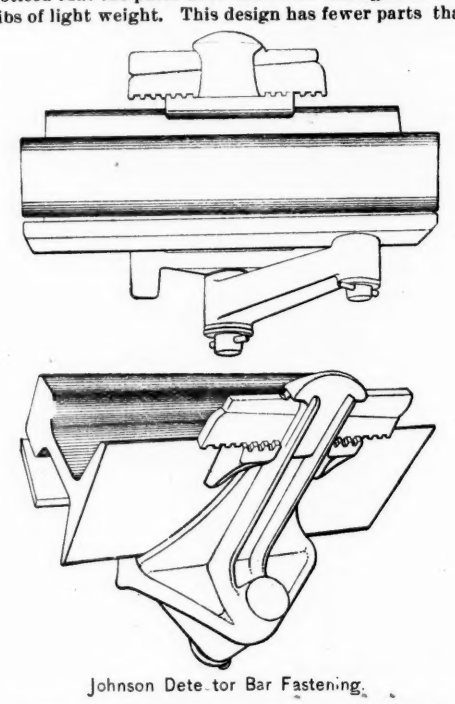
The hour being late, the discussion was then closed.

Johnson Detector Bar Fastening.

We illustrate herewith the improved detector bar clip manufactured by The Johnson Railroad Signal Co., of Rahway, N. J. The modern practice in this country has called for detector bar clips which can be fastened to the rail without drilling it. Hook bolts are extensively used for this purpose, but it is claimed that the keyed clip is as superior to the bolted pattern as the keyed and yoked frogs are superior to those of the bolted pattern.

There have been difficulties to overcome in the production of this improved clip, consisting mainly of the non adjustability when an ordinary gib was used and the weakness of the parts as at first made. In a three years' test, however, it has been proved that where the parts have properly stood the wedging strain this clip remains as fast as though welded to the rail.

The feature of the device here shown is the comb-shaped gib, by which slight inequalities of the rail are provided for. The joint is locked by a simple cut by cold chisel on the face of the taper key. It will also be noticed that the parts have been well strengthened by ribs of light weight. This design has fewer parts than



Johnson Detector Bar Fastening.

that in which hook bolts are used, there being four parts in a keyed clip and seven parts in connection with the hook bolted pattern, including nuts and nut locks.

Railroad Matters in Chicago.

Freight Traffic.—Railroad managers were disappointed at the result of the week just closed. The severe snow-storm which swept over the entire country materially restricted the movement of all descriptions of trains even on the most favorably located lines. The marketing of farm products in the interior was reduced to a minimum. The receipts of grain at Chicago the past week by 11 Western railroads were 3,280,000 bushels, against 4,890,000 bushels the week immediately preceding, and compared with the week ending Feb. 10 last year 2,438,000. The volume of other inbound freight compared well with the same time last year.

The deliveries of flour (bbls.) at Chicago by the leading Western railroads for the week ending Feb. 17, and the same time in preceding years, compare as follows:

	1894.	1893.	1892.
C. & N. W.	13,878	40,349	32,573
Ill. Cent.	.....	1,656	816
C., R. I. & P.	2,450	1,785	3,125
C., B. & Q.	5,039	29,890	15,509
C. & Alton	1,200	1,650	1,200
C. & E. Ill.	.....	.....	.....
C., M. & St. P.	11,825	46,950	22,500
Wabash	300	1,030	850
C. & G. W.	19,482	9,925	14,478
A., T. & S. Fe	.....	150	.....
L., N. A. & C.	.....	.....	.....
Total	54,174	133,379	91,051

The following shows the deliveries of grain (bushels) at Chicago by the leading Western railroads for the week ending Feb. 17 and comparisons with preceding years:

	1894.	1893.	1892.
C. & N. W.	678,000	486,000	487,000
Ill. Cent.	374,000	455,000	275,000
C., R. I. & P.	411,000	129,000	540,000
C., B. & Q.	773,000	764,000	541,000
C. & Alton	127,000	94,000	128,000
C. & E. Ill.	44,000	138,000	106,000
C., M. & St. P.	488,000	244,000	684,000
Wabash	98,000	97,000	74,000
C. & G. W.	138,000	188,000	119,000
A., T. & S. Fe	143,000	232,000	89,000
L., N. A. & C.	6,000	.....	.....
Totals	3,280,000	2,827,000	3,043,000

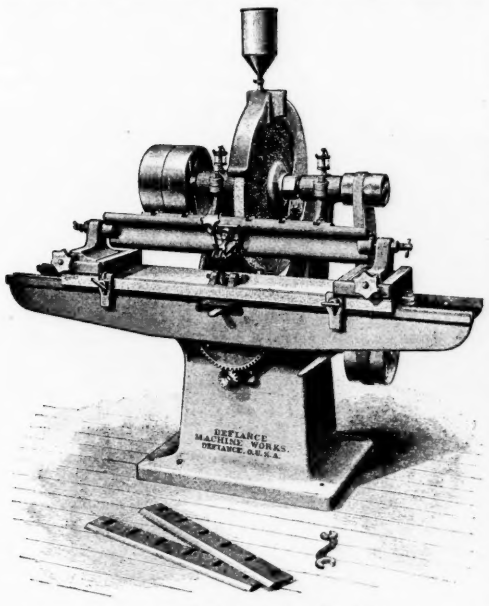
The outbound traffic of all the lines also suffered from the same causes that affected inward business. Merchants express increasing faith that they will have a liberal trade the coming month. Stocks of about all classes of goods in the interior are less than the average at the opening of spring. One General Manager says, however: "We are only figuring on moderate earnings in the near future, and are trying to shape our expenses to conform to them. Live stock receipts for the week were much better than expected, and a surprise to railroad officials."

Passenger Traffic.—All classes of passenger traffic suffered from the effects of the storm, and the earnings were light. The indications of an increased California travel were reported better than at any preceding time the present winter. Recent reports that Western railroads are dispensing with dining cars with a view to returning to the station eating-house system are denied by the officials of the leading roads. Such cars as have been taken off will be reinstated as soon as travel assumes its former volume. They are a profitless adjunct

but, like the limited trains, the best class of travel demands them, and the roads are compelled to continue them on through lines.

Automatic Knife-Grinding Machine.

The engraving illustrates an improved automatic knife grinding machine, designed to embody all the essential features necessary to make it complete for accurately grinding the cutting edges of knives used in woodworking and other machines. The frame is cast in one piece with a cored center, and it has a large floor base. The emery wheel is 21 in. diameter and ½ in. face, and is surrounded by an adjustable shield. The machine is provided with a can for water, and may be used for wet or dry grinding, as preferred, the water being employed to prevent the knife from burning, so that the work can be finished much quicker. The arbor runs in babbit metal, self-lubricating bearings, so inclosed as to prevent the admission of dust and dirt.



Automatic Knife Grinding Machine.

The table can be adjusted for a long or short stroke by stops at the edge, so that the carriage will move forward and back to suit the length of knife. The angle-bar by which the knife is held is adjustable to different angles, so that any bevel can be made—it can be set to grind parallel or to grind a knife which is wider at one end than at the other. The table may also be adjusted to compensate for the wear of the wheel. All the sliding surfaces are accurately scraped to a perfect bearing, and the reversing motion of the table is soft and free from jar; it is automatic, and after being started continues to run until the knife is ground to a perfect edge. The pulleys are 3 × 10 in., and should run at 260 revolutions per minute. This machine is one of the many improved designs of labor-saving machines manufactured by the Defiance Machine Works, Defiance, O., for repairing and keeping in order woodworking and general metal-cutting machines.

Train Accidents in the United States in January.

COLLISIONS.

REAR.

2nd, 5:30 a. m., on Union Pacific, near Linwood, Kan., a freight train of the Chicago, Rock Island & Pacific ran into the rear of a Union Pacific mixed train which was preparing to stop at a tank, wrecking the caboose, 1 passenger car and two cars of live stock. The wreck took fire from a stove and the flames spread rapidly. The conductor and 5 passengers were killed and 4 passengers were injured. Four of the bodies of the dead were completely consumed by the fire.

4th, on Chicago, Burlington & Quincy, at Albia, Ia., the eastbound fast mail train ran over a misplaced switch and into a car standing on a side track. The conductor and 1 mail clerk were injured.

13th, 2 a. m., on Lehigh Valley road, at Phillipsburg, N. J., a freight train ran into the rear of a preceding freight, wrecking the caboose and two loaded cars which were pushed off a bridge 45 ft. high and into the street below. The engine ran across the bridge on the sleepers and then fell down a bank. The engineer was injured.

15th, 8 a. m., on Delaware, Lackawanna & Western, near the bridge over the Hackensack River, east of Newark, N. J., a passenger train, the speed of which had been slacked on account of a signal from a preceding train, was run into at the rear by a following passenger train, wrecking 3 cars and the engine. Nine passengers were killed and about 40 injured, 4 of these dying afterward. These trains left Newark about 4 minutes apart and there was a dense fog at the time of the collision. This accident was reported in the *Railroad Gazette* of Jan. 19.

21st., on Pittsburgh, Cincinnati, Chicago & St. Louis, near Steubenville, O., a freight train descending a grade broke in two and the rear portion afterward ran into the forward one, wrecking 5 cars, which fell down a bank. Three tramps stealing a ride were killed and a fourth was injured.

26th, 5 a. m., on Seaboard Air Line, at Henderson, N. C., a freight train standing at the tank was run into at the rear by a following freight, wrecking the caboose. Two passengers were killed and 1 injured.

And 7 others on 6 roads, involving 12 freight trains.

BUTTING.

13th, 3 a. m., on Texas & Pacific, near Dallas, Tex., butting collision between freight trains 12 and 13, making a bad wreck. Fire started in a car of oil and 5 loaded cars were burned up. It is said that the collision was due to an error in a telegraphic order.

16th, on Bennington & Rutland, near South Shaftsbury, Vt., butting collision between a passenger train and a wrecking train, which was running backward, damaging both engines. There was a dense fog at the time. Four trainmen were injured, 2 of them fatally. It is said that conflicting orders had been issued by the train dispatcher.

23d, on Louisville & Nashville, near Montgomery, Ala., butting collision of freight trains; engineer, fireman and one tramp injured.

24th, on New York & Long Branch, near Asbury Park, N. J., butting collision of passenger trains, doing considerable damage. A mail agent was injured.

31st, on Central Vermont, at Swanton Junction, Vt., butting collision between a passenger train and a freight, badly damaging the engine. Two trainmen were injured.

And 5 others on 5 roads, involving 1 passenger train and 9 freight and other trains.

CROSSING AND MISCELLANEOUS.

1st, on Lehigh Valley road, near Delano, Pa., a coal train pulling out of a side track ran into the side of a passenger train, badly damaging both engines. Both engineers were injured and several passengers slightly hurt.

1st, on Delaware, Lackawanna & Western, at Chester Junction, N. J., an eastbound passenger train ran over a misplaced switch and through a crossover track and into the head of a westbound freight train, doing considerable damage. Two trainmen were injured.

4th, 2 a. m., on Buffalo, Rochester & Pittsburgh, at Warsaw, N. Y., a freigh train just starting from the station was run into at the front by the caboose and 6 cars of a preceding freight train which had run back down a grade, presumably on account of the carelessness of the brakeman in going to sleep and leaving the cars unattended while switching was being done. Two employees were killed and another injured.

5th, on New York, New Haven & Hartford, at South Braintree, Mass., collision between a passenger train and a yard engine which was using the main track without right. Engineer, fireman and 1 passenger injured.

7th, on Seaboard & Roanoke, near Portsmouth, Va., collision of passenger trains, doing slight damage and injuring 3 passengers.

8th, night, at switch near the west approach to the bridge over the Mississippi at Clinton, Ia., a Chicago, Burlington & Quincy passenger train backed into the side of a Chicago & Northwestern eastbound freight, derailing the way car, which fell down the embankment, wrecked the telegraph office at the end of the bridge. Four boys who were loafing in the telegraph office were injured, one of them fatally.

16th, on Chicago, Burlington & Quincy, at Hawthorne, Ill., a passenger train ran into a freight train switching on the main track, damaging several freight cars and injuring the engineer. There was a dense fog at the time.

17th, 1 a. m., on Florida, Central & Peninsular, at Chester, S. C., a passenger train was run into by a freight of the Georgia, Carolina & Northern at the crossing of the two roads, overturning a sleeping car. Six passengers were injured.

23rd, on Wabash road, near Springfield, Ill., a mixed train of the St. Louis, Chicago & St. Paul ran over a misplaced switch and into a Wabash coal train, badly damaging both engines. One passenger was injured.

27th, on Southern Pacific, at Oakland, Cal., collision of locomotives in the yard. A boy riding on the front end of one of them jumped off and was injured.

And 8 others on 7 roads, involving 4 passenger and 9 freight and other trains.

DERAILMENTS.

DEFECTS OF ROAD.

2d, on Baltimore & Ohio, near Bremen, Ind., a passenger train was derailed by a broken rail, making a bad wreck. The mail car and 2 passenger cars fell part way down a bank. A mail clerk and 2 passengers were slightly injured.

11th, on Pittsburgh, Shenango & Lake Erie, at Watson's Run, Pa., a mixed train was derailed, it is supposed, by a broken rail, and the passenger car and 9 freight cars wrecked. Three trainmen were badly injured, 2 probably fatally.

14th on North Pacific Coast Railroad, near Cazadero, Cal., an engine fell through a bridge and into Austin Creek. Seven men on the engine were drowned, and the creek being very high, two of the bodies were carried out to sea. The engine had been run out by the conductor and engineman to learn the condition of the road, much rain having fallen. At the bridge in question the conductor went forward on foot and the disaster occurred after he had walked about a mile, so there is no survivor to tell how it happened, the bridge being in a secluded place. Four of the victims were riding merely for entertainment.

23rd, on Burlington, Cedar Rapids & Northern, near Postville, Ia., a freight train was derailed by a broken rail and 4 cars were ditched; engineer killed and fireman injured.

25th, on the Columbia Branch of the Southwestern of Georgia, near Ducker, Ga., the engine of a freight train was derailed and overturned by striking a "snake head." It appears that on this part of the road the old fashioned track, consisting of light rails fastened to longitudinal wooden stringers, is still in use.

28th, on Union Pacific, near Como, Col., a rotary snow plow, being pushed by two engines, was derailed by a broken rail and the plow and one of the locomotives fell down a high bank. It is said that the plow rolled over three times. Five employees were injured.

30th, on Central of Georgia, near Clio, Ala., 3 cars of a passenger train were derailed by a broken rail and fell down a bank. Three passengers and 1 trainman were injured.

And 4 others on 4 roads, involving two passenger and 2 freight trains.

DEFECTS OF EQUIPMENT.

1st, on St. Louis, Iron Mountain & Southern, at Higginson, Ark., the locomotive of a freight train was wrecked by the explosion of its boiler and 14 cars were derailed. Most of these were loaded with cattle and many animals were killed. The conductor and fireman were killed and engineer injured.

8th, on Union Pacific, at Clark's, Neb., westbound passenger train No. 1 was derailed and one sleeping car was overturned. It took fire from the lamps and the stove and was burned up. Three passengers were injured. The derailment was due to a loose switch which was damaged by a broken brake rod on a preceding car in the same train.

29th, on Pennsylvania road, near Steelton, Pa., an eastbound freight train was derailed by a broken axle, and several cars were thrown upon the westbound main track. The wreck was run into by a westbound freight and the engine and 19 cars were wrecked. A fireman was injured.

And 10 others on 9 roads, involving 1 passenger train and 9 freight and other trains.

NEGLIGENCE IN OPERATING.

4th, on Lehigh Valley road, at Allentown, Pa., a feight train approaching the crossing of the Central of New Jersey was ditched at a derailing switch, the engineman having disregarded the signal to stop; brakeman and fireman injured.

7th, night, on New York, New Haven & Hartford, at Plymouth, Mass., a runaway locomotive ran off the end of the track at the station and was badly damaged. The engine had been run out of the yard at East Whitman while the watchman was off his guard, and the men who took it and started out for a ride jumped off some distance before reaching Plymouth.

8th, on South City & Pacific, at Missouri Valley Junction, Ia., a passenger train was derailed and 2 passenger cars fell down a bank. One passenger was killed. It is said that a switch was turned under the train.

27th, on Baltimore & Eastern Shore road, near Berlin, Md., a freight train was derailed by a misplaced switch and 2 cars wrecked. The engineer was injured.

30th, on New York Central & Hudson River, at Albion, N. Y., a passenger train ran over a misplaced switch and the engine fell into a turntable pit. The engineer was badly injured.

31st, on Pennsylvania road, at Columbia, Pa., a passenger train ran over a misplaced switch and crashed into a brick factory, doing considerable damage. The engine was overturned and 2 trainmen were injured.

And 5 others on 5 roads, involving 3 passenger and 4 freight and other trains.

UNFORESEEN OBSTRUCTIONS.

2nd, on Missouri Pacific, near Coffeyville, Kan., a passenger train was derailed at a point where a rail had been maliciously misplaced, and the engine ran over a trestle on the sleepers.

12th, on Atchison, Topeka & Santa Fe, at Algodones, N. M., a freight train was derailed by planks which had been maliciously placed upon the track, and 15 cars of oranges were ditched. Several similar attempts had been made in the vicinity and the detectives believe they are the work of "White Cappers."

13th, on Union Pacific, near Chehalis, Wash., a work train was derailed by running into a landslide, and the engine was overturned, killing the engineer.

15th, on Pennsylvania road, near Spotswood, N. J., a passenger train ran over a number of rails that had been piled upon the track and the tender was derailed.

19th, on Southern California, at Rincon, Cal., a freight train was delayed by running into a land slide and the engine and several cars fell down a bank. The engineer and fireman were injured.

22d, on Central of Georgia, near Fitzpatricks, Ala., a passenger train was derailed by running over a cow and the engineman and fireman injured.

And 5 others on 4 roads, involving 4 passenger trains and 1 freight.

UNEXPLAINED.

9th, 1 a. m., on Pennsylvania road, near Franklin Park, N. J., 2 cars in a freight train were derailed, making a bad wreck, which took fire, burning up 10 cars. One brakeman was injured.

10th, on Chicago, Rock Island & Pacific, near Grinnell, Ia., a mixed train was derailed and 10 freight cars were ditched. The caboose was overturned and took fire. Eight passengers were injured, some of them being burned.

15th, on Wabash road, near Clifton Hill, Mo., a dead engine in a freight train was derailed and several cars went off the track with it. A man in charge of mules was killed.

18th, on Cleveland, Cincinnati, Chicago & St. Louis, near Alton, Ill., a passenger train was derailed and the engine and the one car were overturned. The conductor was injured.

26th, on Grand Rapids & Indiana, at Edgerton, Mich., a freight train was derailed and 20 cars were wrecked. Several trainmen were injured.

28th, on St. Louis, Chicago & St. Paul, at Curran, Ill., a work train was derailed and wrecked. The engineer was killed and several employees injured.

And 17 others on 17 roads, involving 6 passenger and 11 freight and other trains.

OTHER ACCIDENTS.

11th, on Concord & Montreal, at Belmont, N. H., the locomotive of a freight train was wrecked by the explosion of its boiler and the engineer and fireman badly injured.

15th, on Cleveland, Cincinnati, Chicago & St. Louis, at Winchester, Ind., the engine of a freight train was wrecked by the explosion of its boilers. The fireman was killed and 1 brakeman injured.

24th, on Missouri, Kansas & Texas, at San Marcos, Tex., a car in a passenger train was wrecked by the explosion of the heater and 2 passengers were killed and 3 injured. It is said that the explosion was due to the stoppage of pipes by ice.

And 3 others on 3 roads, involving 3 passenger trains.

A summary will be found in another column.

New Surveys of Old Lines.

The Fitchburg Railroad has had a good job done by having made a complete survey and record of its property between Boston and Fitchburg. This work has been done by Messrs. H. C. Knapp & Co., of Boston. The record comprises a set of volumes of plans, which present every detail of information pertaining to the location and construction of the road. Many railroads like the Fitchburg have been laid out and constructed with only sufficient engineering work to serve as the basis of a contract. From time to time plans have been made of limited sections to serve special purposes, but they usually included only such details as were required at the time. These were usually piled away in the office of the engineer, or sent to the officers of the law department or the executive, and never came back. The result has been that the accumulation of fragmentary and partial plans has been of but little value. If a plan of a given location was required, the engineers have had to be sent out to do the work hastily and for the special purpose, adding another to the accumulation of fragments. The work done has included the overhauling and classification of all records of land titles, surveys, maps, plans, etc., in the archives of the road, and these were made the basis of an entire survey of the line and all its belongings.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The orders of Judges Jenkins and Dundy against striking are still the subject of discussion in the West. The discussion thus far has been mostly in the shape of newspaper interviews (in which Judge Dundy, Judge Caldwell, of the Circuit Court, and other judges have taken part), and it has therefore been fragmentary and inconclusive, but the question is now likely to soon receive more comprehensive attention, as the Brotherhood leaders, representing the Northern Pacific employees, have asked the Court at Milwaukee to modify the orders that were issued against them on Dec. 19 and 22. Their application is to be heard today, Feb. 23. The Union Pacific order by Judge Dundy still stands. Judge Caldwell, superior to Judge Dundy, disapproves it, saying that he would in such a case require the Receiver to give employees 60 days' formal notice before reducing pay; but this disapproval is in the shape of an informal conversation with the Union Pacific's chief counsel, and it does not appear that it affects the existing order. Judge Caldwell indulged in a little superfluous "taffy," saying that he would require notice to be given to the heads of the labor organizations of the date of hearing, and have the Receiver give those labor representatives transportation and subsistence while attending court. That is, he would give the dignity of legal sanction to the courtesy usually granted to grievance committees by railroad managers, and extend it a little. Whether the subsistence would be for a committee of nine or of 90, and whether at five-dollar-a-day hotels or some other kind, he did not state. The main question at the bottom of all this talk is very simple. For employees to meet secretly, when off duty, and agree to quit work simultaneously at the end of a day or of a trip, without notice, because their pay or their treatment is unsatisfactory, is universally agreed to be lawful (in the absence of any contract to the contrary). But for men to plan to quit at such a time that the employer will have to do something more than get new men in their places, and to exaggerate grievances so as to over persuade fellow-employees, are generally reprehended as unlawful. The labor leaders are declaiming against the judges for condemning the former, while the judges assert that their orders were intended to refer only to the latter. As we intimated last week, there is no indication as yet that the courts will abridge any one's rights.

Two railroads that have been experimenting with compound locomotives for the past two years have reached the important conclusion that in freight service the compound locomotive, if reasonably well designed, will, without unusual care, effect a saving in fuel of fully 20 per cent. Most of the old prejudice against the compound mechanism is gone; it has been driven out by daily experience with the devices, accomplished in these two cases by shifting the compound from one division of the road to another, and finally leading to a recommendation to the management to consider the advisability of using compounds hereafter. Using 20 per cent. less fuel and water means less labor in several directions, and some considerable decrease in the cost of repairs to the boilers. The compound locomotive committee appointed by the Master Mechanics' Association several years ago must have been discontinued last year, as there is no announcement of such a committee in the list given in the last *Proceedings*. Such a committee would find more to report upon this year than it had last, and it is unfortunate that it was discontinued. Upon the revival of locomotive building it is probable that a larger percentage of compounds will be built than ever before: and in the near future the majority of all engines to be used exclusively on grades will undoubtedly be compounded, for reasons that we have often set forth.

Among the committees appointed by the Master Mechanics' Association to report this year, none is so important as that on "Boiler and Firebox Steel." This Committee has had one meeting and it is to be hoped that work will not be intermitted. There never was a time when steelmakers were as ready as now to fill any reasonable specification at a low price. Firebox and shell steel according to government specifications has been recently sold at a price lower than inferior boiler steels were sold at last year, and now is the time to make up a standard specification for locomotive boiler steels that will answer all the practical requirements for a long time to come. This is what is expected of the Committee, and there are several railroads which are awaiting the report of the Committee, hoping that it will contain a recommendation looking to standard specifications.

One of the subjects that will need consideration soon in connection with the Rules of Interchange is: How shall air-brake triple valves be treated at points of interchange? If one road offers to another a car with the brake cut out, is it fair to assume that the brake is defective? If the brake is defective in the triple valve, whether from leakage or from stoppage with dirt, shall a defect card be given for such defects? In order to facilitate the interchange, can a railroad company receiving a car with a defective triple put on a new triple, charge for it and make an allowance for the one taken off? Or must the road receiving the car, if it desires to use the air-brake, hold the car until the triple is cleaned or repaired? What means should be provided for examining a triple valve to learn if it is defective, when a car is received with the brake cut out? These and other questions pertaining to the interchange of air-brake cars between roads using the air-brake in freight trains are beginning to accumulate with considerable rapidity, partly owing to the fact that there are quite a number of cars in service with experimental triples that are generally unfit for use. The quickest way to make a car ready to run which has a defective triple is to replace that triple with another of the same kind and let the car go forward, unless the defect is only in the strainer being clogged, in which case it is a comparatively simple matter to clean or replace the strainer; but it must be known if the defective strainer is the only defect, and this requires an examination. It would be a great waste of time if the triple were still found defective after the strainer had been cleaned, and therefore under some conditions it may be well for connecting lines to have an agreement about the removal and substitution of triples. This leads up to a conclusion that is perfectly practical and logical, viz.: that there should be a requirement that triple valves should interchange in position and size of fittings. The Master Car Builders' Interchange Rules for the replacement of couplers permits the substitution of any vertical plane coupler in the place of one that is broken, provided the M. C. B. standard dimensions are followed. When the air-brakes are generally used for freight trains, the question of the treatment of defects at interchange points will probably be as important as the treatment of draw-bars and couplers.

In another column will be found extracts from an important paper on counterbalancing locomotives, read by R. A. Parke before the New York Railroad Club, and we have also discussed it editorially. The practical bearing of the paper is greater than might appear at first sight, as the mathematical discussion in the paper is somewhat involved, although the conclusions are simple and can be easily used by anyone having a knowledge of common algebra and trigonometry. The paper relates specifically to the effect of locomotive driving wheels on the track, which is a matter that has been recently brought out by the *Railroad Gazette* (Dec. 15 and Jan. 5) for the purpose of again calling attention to the need of reducing the weight of the reciprocating parts, and to the advantages of large driving wheels, both of which reduce the effect of the counterbalances on the track. An actual case of destruction of track, which emphasizes all this matter has occurred within a few weeks. A locomotive without connecting and side rods was hauled at a speed of about 50 miles an hour with the result that one bridge was so badly damaged that several suspension rods had to be removed, and a thorough inspection of the whole structure had to be made and several miles of track were very badly damaged. The increase in speed of freight trains in this country requires that when locomotives are to be hauled in trains either a proportion of the counterbalance shall be removed or that an additional counterbalance shall be placed on the crank pin during transit to take the place of the missing rod. We have heretofore described a case where a partly disconnected disabled consolidation engine damaged a considerable length of track while hauling its train into a terminal. The result was an order requiring engineers running disconnected engines not to go faster than 20 miles an hour. The effect of the counterbalance on the rail increases as the square of the speed, and consolidation engines with small wheels for fast freight trains should only be used after their counterbalancing has been carefully examined. In saying what we have said about counterbalancing locomotives, we have not intended to take sides with the hammer-blow disputants, and our remarks have no practical application other than to show that for high speed light reciprocating parts and large drivers are very desirable, and also that disconnected locomotives should not be run at high speed. The mechanical officers of railroads should be required to make careful examinations of the counterbalancing of each individual engine. Proof that each individual engine needs examination is found in the fact that in a lot of engines recently purchased there was a wide difference in the amount of counterbalancing in the different engines, and some of them had to be re-balanced before they were safe to run.

Counterbalancing in Locomotives.

In accordance with the suggestions made in the *Railroad Gazette* of December 15 last, Mr. R. A. Parke has taken up the subject of counterbalancing for locomotives and thrashed out many of the difficulties, screening the results so that they may be utilized in practice. In doing this Mr. Parke has conferred a lasting benefit upon railroad mechanics and deserves great credit for the admirable manner in which it has been presented. Such philanthropic work, done without expectation of gain, deserves the highest praise. An abstract of the paper is given in another column. Mr. Parke's calculations are entirely with respect to the locomotive, leaving out all treatment of the question with reference to the track. He has taken up nearly every case which can arise; and his results are not simply approximations, but have been worked out with great mathematical skill and accuracy. With the exception of a few unimportant criticisms made in the discussion at the club meeting, Mr. Parke's calculations seem to be correct. They have been carried out for conditions that are substantially the same as those under which the locomotive worked at Purdue University, and will afford valuable comparisons with the practical results in those tests. It may be proper here to correct a few slight mistakes in the report of the tests at Purdue which were explained by Professor Goss in discussing Mr. Parke's paper. Mr. Goss distinctly stated that the engine did not rise from the track at speeds of 40 nor at 50 miles an hour, but that the driving wheel did rise at 59 miles an hour. He also corrected the ambiguous statement in the report of the tests that the nick upon the tire was made opposite the counterbalancing, as the nick was really made upon the heavy side of the driving wheel. The engine at Purdue is balanced for the reciprocating parts, so that it may be restrained and held in place when running at high speeds.

With these explanations Mr. Parke would undoubtedly forego his criticisms of those tests, for his mathematical deductions compare very favorably with the practical results of the experiments. With full orizontal balancing on a standard Schenectady locomotive Mr. Parke, at a speed of 75 miles an hour, finds the greatest lift of the driver to be .3 in., and that the angle while free is about 43 degs., while that reported from Purdue tests, for speeds of 59 miles an hours, was a lift of something more than 0.05 in. (the thickness of wire) and for an angle of about 50 degs.

This paper by Mr. Parke and that by Mr. Seymour

published in our last issue, represent the extremes of theory and practice, though both gentlemen have doubtless given considerable attention to both sides of the questions. The conclusions arrived at are distinctly those deduced by theory on the one hand and from practical observation on the other, and it will be difficult to reconcile them. Mr. Parke's paper is the more tangible, and contains practical results which should be of great value to locomotive designers. It may be doubted, however, whether the paper will have much effect, for, as was said in the discussion, locomotives are built to please engine men and Master Mechanics, without particular regard to the effect on the track and bridges.

Mr. Seymour presents a number of things that well deserve consideration, and that are frequently overlooked. Some statements that tend to discredit "the inspirations of mathematical formulæ" with regard to wheels on shafts would be answered promptly if made more definite. And the statement that an overweight of w pounds will bring a strain upon the shaft in the direction of the overweight is undoubtedly true under the usual conditions. That journals of shafts wear most on that side of the pulley which is lightest when hung between two hangers is novel to most of us. It is contrary to the principle of the ball governor. The statement that "the conditions under which the Purdue University locomotive was running were entirely different from those under which an engine runs on a track" may be true: but the effect of the counterbalance on the engine and the vertical influence on the track are the same nevertheless. The same objection was made in a letter to the London *Engineering* of Jan. 12, and Rankine, Molesworth and Todhunter were cited in support of the theory.

The idea that it makes any difference as to the vertical influence or of its effect on the engine may be disproved by the same "inspiration of mathematical formulæ" so mysteriously and unfavorably regarded by many practical men. We have been unable to find any authority in Rankine, Molesworth or Todhunter for the statement that the vertical influence determined, is any more or less when treated as a rolling wheel upon the track than when treated as a wheel revolving about its center and moving with the engine.

The crank-pin and counterbalance of a driving wheel running on a track follow the path of a trochoid with reference to the track, and of a circle with reference to the locomotive. If the equation of the trochoid be determined and an expression of its radius of curvature be derived, and the vertical lifting or depressing influence be obtained from the conditions attendant, it will be found to be equivalent to the influence obtained when the path is taken as a circle referred to the locomotive itself.

These papers should have their influence in modifying existing practices in counterbalancing, and general managers and superintendents should use their influence to bring about a reconciliation between the motive power and engineering departments of their roads, so that the track and road structures shall be duly considered in the designs of rolling stock, especially locomotives.

Railroad Company Failures.

The prevailing depression in business and attendant light traffic and earnings had continued but a few months, when several of our great railroad companies were unable to pay the interest on their debts, and were placed by the courts in charge of receivers for the protection of their creditors and others interested. That great corporations, working properties, in some instances, which represent a capital of a hundred millions or more, should fall almost at the first adverse blast, has doubtless astonished many who have a knowledge of business in general, if not of railroad business; and the Chicago *Tribune* has taken the pains to solicit the judgment of leading railroad managers on the matter. These gentlemen have very generally found one of the obstacles to earning interest on railroad investments in the Interstate Commerce law, especially the section forbidding pooling, and the "short-haul" clause.

This is all very well. These provisions of the law do stand in the way of certain reasonable profits, which on some lines would be very important; and the railroad men being invited to take the public into their confidence, very properly have pointed out an evil for which the public is responsible, and which the public alone can remedy.

But there are other things than the Interstate Commerce law which render most American railroad companies more liable to bankruptcy than most other business enterprises—things which are chargeable to the companies themselves, or to the people who organized and financed them: and to one of these we purpose to call attention here.

Nearly all kinds of business fluctuate in all countries. Profits are larger in some years than in others—a truth which everybody admits—while people are much slower to believe, or act as if they believed, the corollary that profits are *less* in some years than in others. The consequence is that if a man attempts to do a business wholly on borrowed capital he is sure to fail eventually unless he bases his calculations on the worst possible year, and, at all events, the business is conducted wholly at the risk of his creditors. A purely mercantile business, in which goods are bought and sold simply, with very little change in market value between the buying and the selling, can be conducted on a very large scale with a comparativey small capital; but a railroad is properly comparable rather with a manufacturing business requiring an enormous and costly plant, only the products of which are sold.

If then a manufacturer requiring $100,000 capital in his business should borrow $90,000 of it and make only ordinary interest on the whole, a reduction of anything more than 10 per cent. in profits would leave him unable to pay interest on the money he had borrowed, though such a reduction, or one much greater, in a considerable term of years, is almost sure to occur.

This seems as if it might be intended for a primer for investors of tender years; but hoary-headed men of great business reputation have financed great railroad companies in that way, and then seem surprised that occasionally the companies fail—and fail more than once sometimes.

Let us look into some recent cases: The New York, Lake Erie & Western Railroad is one of the great lines of the country, with a very large traffic. Below we give its gross earnings, net earnings, total net income (including some interest on investments, besides the net earnings), the charges against this net income, which have to be paid to keep the company solvent, and the surplus income over these charges, which alone is the company's—that is, the stockholders'—profit.

New York, Lake Erie & Western.

Year to Sept. 30—	1891.	1892.	1893.
Gross earnings	$30,475,793	$31,660,350	$30,401,254
Net earnings	9,907,895	9,865,641	9,9 0,716
Net income	10,562,834	10,607,919	10,576,530
Charges	9,557,456	9,874,660	9,659,092
Surplus	$1,005,378	$733,259	$917,438
P. c. of net income	9.52	6.93	8.68
P. c. of gross earn.	3.30	2.32	3.02

Now note the proportion of the surplus—the profit—to net income and the gross earnings. The property has large earnings and even large profits, 10½ millions and more in each of these years; but in the best of these years $90.48 out of every $100 of the property's profits, and in the most $93.07, had to go to pay interest on money borrowed on rents of parts of the property hired (We have arranged the figures in the form usual in railroad reports, from which form this company's reports differ, in order to give all the charges together. Take the last year, for instance, for every $100 of the 30 millions of gross earnings, the company had to pay $67.30 for working expenses, and then $31.79 for interest, rents, etc., leaving but a beggarly 93 cents for the company's profit, which is increased to $3.02 by some profits other than net earnings.

Now, in such a situation, with from 90½ to 93 per cent. of its net income absorbed by its debts, and only 2⅞ to 3⅛ per cent. of its gross earnings left as profits to the company, who can wonder that this great company has been several times at the mercy of its creditors—though this seems hardly the proper expression; for the creditors have certainly been strangely merciful if they really had the company at their mercy.

For the sake of contrast, compare the Erie's situation with that of one of its great rivals, the New York Central, as shown below:

New York Central & Hudson River.

Year to Jan. 30.	1891.	1892.	1893.
Gross earnings	$37,902,114	$45,478,625	$46,9 6,693
Net earnings	12,531,262	14,389,512	14,641,816
Net income	12,620,002	14,416,863	14,872,239
Charges	8,954,186	9,812,120	10,111,947
Surplus	3,665,816	4,604,737	4,760,292
P. c. of income	29.00	31.94	32.03
P. c. of gross earn.	9.67	10.12	10.14

This company, like the Erie, has to pay out more than two-thirds of its receipts for working expenses; but while the Erie's interest and other charges absorb more than nine-tenths of the profits of the property, the New York Central's charges are not one-third of its income, and of every $100 of gross receipts, about $10 is the *company's* profit. Its income would have to be reduced two-thirds before it would have any occasion to ask to have Dr. Depew appointed Receiver. Note that with earnings about one-half greater than the Erie's, its charges against income are about a half a million less.

Let us now go west and diagnose the cases of some of the sick railroads there. And first, the Union Pacific:

Union Pacific.

Year to Dec. 31:	1890.	1891.	1892.
Gross earnings	$43,049,218	$42,699,588	$43,135,050
Net earnings	12,238,084	13,539,310	14,370,1 0
Net income	13,435,856	15,340,054	16,496,851
Charges	12,657,172	12,981,782	13 068 961
Surplus	778,686	2,358,272	3,427,890
P. c. of net income	5.8	15.4	20.8
P. c. of gross earnings	1.85	5.52	7.96
Gov't requirements	1,053,723	1,293,230	1,358,134
	(D.) 275,037	(S.) 1,665,042	(S.) 2,069,756
P. c. of inc.	2.05	6.95	12.54

What big figures in the gross and net earnings and what little ones in the surplus! Yet the net income is largely swelled by the income on investments, which the company pays itself, having issued bonds to pay for stock and leasing the properties covered by the stock at rentals which exceed the net earnings, and the "government requirements" are much less than the interest yearly accruing, but only that part of it which the law requires to be paid yearly. This is a peculiar case, it is true, but the inability of the company to pay interest in a bad year ought not to surprise any one.

If we compare the Union Pacific with the New York Central, above, we find that it has nearly as great gross earnings, nearly the same net earnings, and a larger net income; but it has to pay $4,300,000 more for interest and rentals.

Now for the Union Pacific's suffering brother on the north:

Northern Pacific.

Year to June 30:	1890.	1891.	1891.	1893.
Grossearn.	$22,610,503	$25,151,544	$24,661.457	$23 920,108
Net earn.	9,146 757	9,750,548	10,084,108	8,985,996
Net income	10,487,929	11,343,683	11,748,312	11,152,723
Charges	9,540,770	10,905,395	11,851,238	12,041 977
Surplus	$947,159	$438,288	(def)$103,026	(def)$889,254
P. c. of income.	9.03	3.86	0.88	7.97
P. c. of gross earn.	4.19	1.74	0.42	3.72

A larger proportion of the earnings of this railroad are net, and it has an important income outside of net earnings; but in the most favorable of these four years 91 per cent. of its income went to pay interest and rentals; in the last year 8 per cent. more than its income was needed to meet these charges. Like all these other companies (except the New York Central), it owes too much.

But there is another sufferer to the South:

Atchison, Topeka & Santa Fe.

Year to June 30:	1891.	1892.	1893.
Gross earnings	$33,667,716	$36,438,188	$41,316,547
Net earnings	9.620,547	11,227,255	12,710,746
Net income	10,590,762	12,045,535	13,539.104
Charges	9,936,159	10,480,630	11,620.724
Surplus	454.543	1,564,905	1,918,380
P. c. of net income	4.38	13 00	14.17
P. c. of gross earn.	1.35	4.30	4.64

Out of $100 of receipts last year (the most favorable one) $69.24 went for the cost of doing it, $28.15 for interest and rentals, and the $2.61 left, added to an income from other sources, gave only $4.64 for profit—an amount easy to wipe out by not very bad times. Six-sevenths of its *net income* was absorbed by the charges last year; more than nineteen-twentieths of it in 1890-91. This is sailing too close to the wind.

As a contrast to the above companies, we give below the gross earnings, net income, charges against income, and surplus over such charges for the last year reported on three Chicago dividend-paying railroads, and on the Louisville & Nashville, as follows:

	Gross earn.	Net income.	Charges.	Surplus.
Chic. & N. W	$32.709.747	$11,181,229	$6,401,519	$4.779,710
Chic., Burl. & Q.	33,002,394	12,003,773	7,193,497	4 810 276
Chic., Mil. & St. P.	33,975,055	11,609,087	7.086,686	4,522,401
Lo'isv'e & N'shv.	22,403,639	8,437,105	5,914,554	2,522,551

The surplus on these roads in this year was 42.73, 40.70, 39.0 and 29·9 per cent. of the total net income respectively, and 14.61, 14.55, 13.50 and 11.26 per cent. of their gross earnings. Such companies can stand a very long siege of very bad times without any worse misfortune than the reduction or passing of dividends—unless, indeed, they should be foolish enough to pay dividends which they have not earned. The Northwestern's prior charges have required only from 56.8 to 62.3 per cent. of its net income for the last four years, the Burlington's from 59.3 to 64.7, the St. Paul's from 61 to 76.6; and after paying 7 per cent. on its preferred stock the latter had 7.4, 24.4, and 23.9 per per cent. of its net income left for the last three years respectively, and the Northwestern 21.7 to 29.4 per cent. of its in the last four years.

These, however, are not the strongest of the Chicago railroads, even, meaning by "strength," the ability to endure adversity. As an example of a really "strong" railroad we go to New England and cite the position of the Boston & Albany for the last three years:

Boston & Albany.

Year to June 30:	1891.	1892.	1893.
Gross earnings	$9 216,222	$9,863,316	$10,169,875
Net earnings	2,408,471	2,460,133	2,419.765
Charges	740,900	595,067	390,900
Surplus	$1,667.571	$1,865,066	$2,028,886
P. c. of net income	69.84	75.81	83.83
P. c. of gross earnings	18 09	18 90	19.95

In the last year $100 in gross earnings cost $76.21 for

working expenses and $3.84 for interest and rentals, leaving $19.95 as profit for the shares. Only one-sixth of its income went for charges, and the calamity which would bankrupt nine tenths of the railroads of the country would only reduce its dividends.

From these instances, which might be multiplied indefinitely, it will appear that a comparatively slight reduction in gross earnings, unless accompanied by a reduction of expenses, will bring many a great railroad to insolvency, and that ordinarily all but a small part of their net income is required to pay their debts by a very large number of companies. The recently published report of the Interstate Commission on the income of 145,870 miles of railroad during the year ending with June last, shows that in the aggregate 76.4 per cent of their net earnings went for charges prior to dividends, and 92.4 per cent, of their gross earnings. The 24.6 per cent. of net income remaining is their margin of safety, which we have seen above to vary from nothing or less to 83.8 per cent. The fact that a reduction of only 8 per cent. in gross earnings, if there were no saving in expenditures, would leave this 146,000 miles of railroad unable to meet their debts as they accree—this being their *average* condition—explains the eagerness of managers to reduce expenses, sometimes by heroic means, when there is not very great and apparently temporary falling off in earnings. The companies must economize or die.

Below we give the percentage of gross earnings and of net income absorbed by working expenses and charges prior to dividends on each of the railroads whose accounts we have examined above for the last year reported.

For every $100 of gross earnings and of net income, the 25 following companies owed for expenses and prior charges:

	Of gross earnings.	Of net earnings.
Boston & Albany	$80.05	$16.17
Chicago & Northwestern	85.39	57.27
Chicago, Burlington & Quincy	85.45	59.36
Chicago, Milwaukee & St. Paul	86.70	61.09
New York Central & Hudson River	89.86	67.97
Louisville & Nashville	88.74	70.19
Atchison, Topeka & Santa Fe	95.36	85.83
Union Pacific	95.20	87.46
New York, Lake Erie & Western	95.98	91.32
Philadelphia & Reading	96.31	91.45
Northern Pacific	103.72	107.97

The last five of these companies, all now in receivers' hands, have their whole margin of safety exhausted by a reduction of 5 per cent. in gross earnings and of 8 to 15 per cent. in net income. We submit that this is too narrow a margin, and that the danger of it should be recognized in all plans for reorganization; and also that generally in this country future additions to capital should be made much more by share issues and much less by bond issues than they have been heretofore.

The Chicago & Alton.

The Chicago & Alton Railroad Company has already issued its annual report for the last calendar year. The gross earnings were 2 per cent. less than in 1892, and the smallest since 1890; but a decrease of 3 per cent. in working expenses left the net earnings only $12,060 (0.4 per cent.) less than in 1892. The change on the whole is insignificant, but it was due to a very large increase in passenger traffic and earnings, offset by a large decrease in freight traffic and earnings.

The passenger traffic has been, in *millions* of passenger miles:

1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.
111.3	120.0	118.0	104.0	117.0	112.5	132.0	158.0

Thus last year's travel was 20 per cent. greater than that of 1892, and 40 per cent. greater than that of 1891. Yet the number of passenger journeys was slightly less last year than the year before; but there was an increase of nearly one-third in the number of through passengers, and the average passenger journey increased from 59 to 72 miles. The great cuts in rates in the summer of 1892 brought down the average so low that in spite of the large travel to the World's Fair at reduced rates, the average rate per passenger mile increased from 1.780 to 1.836 cents, and there was an increase of $549,049 (20.3 per cent.) in passenger earnings.

The freight traffic has been, in *millions* of ton miles:

1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.
560.8	641.7	533.9	537.3	519.7	547.5	555.2	483.2

We have to go back to 1882 to find a freight traffic as light as last year's, and the decrease from 1892 was 13 per cent. The course of freight traffic is unlike what it has been on most Chicago roads, where there have generally been great gains since 1886; but we must remember that this company is almost the only one which has not made great additions to its mileage, and that new through lines between Chicago and Kansas City have greatly reduced the proportion of the through freight between these places which the Chicago & Alton can command. A smaller proportion than formerly of its freight is through business, and this will explain why its average rates have been more stable than on most other Chicago roads. As early as 1884 the Chicago & Alton had an average freight rate of 1.01 cents per ton per mile, since which time it has been:

1885	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.
1.01	0.95	0.95	0.92	0.92	0.883	0.913	0.898	0.884

The decrease since 1888 has been four per cent.; since 1885, 12½ per cent.—this, be it remarked, in face of a traffic which decreases rather than increases. The company's lines are crossed at frequent intervals by through lines to the East, which compel very low local as well as through rates.

With a large decrease in freight traffic and a small one in rates, the freight earnings decreased $710,479, or 14¼ per cent.

The increase of one-fifth in passenger traffic was carried without any increase in passenger-train mileage, and thus the average passenger train load increased from 59 to 71 passengers and the earnings per passenger-train mile from $1.21 to $1.46—indicating that the gain in passenger earnings was nearly all net. The decrease of 13 per cent. in freight traffic was accompanied by a decrease of 12⅛ per cent. in the freight train mileage, and the average freight train load decreased only from 155 to 154 tons. It has been about the same for the last four years, but much less than before 1890. It ranged from 184 to 190 tons for the six years previous to 1888. This decrease is probably due to the smaller proportion of through freight, and the consequent larger proportion of cars hauled empty. The portion of empty car mileage has increased from 34.4 per cent. in 1890 to 38.2 per cent. last year.

On this road, as on the Burlington, an examination of the monthly passenger and freight earnings shows how greatly the bad condition of business in the last half of the year was concealed by the increase of passenger earnings due to the World's Fair. Down to the end of April passenger earnings were nearly the same as the year before (¾ per cent. less). Then came the Fair, with gains of passenger earnings 15 per cent. in May, 48 per cent. in June, 40 in July and August, 51 in September and 54 in October; while in November, when people were going home, there was also a gain of 19 per cent., followed by a decrease of 18 per cent. in December. In the seven months from May 1 to Nov. 30 passenger earnings increased $587,600, or 39 per cent.

Meanwhile freight earnings were nearly 10 per cent. greater in April and May than the year before, but for the five months ending with May were only slightly greater (1⅛ per cent.). The era of bad business began with a decrease of 7 per cent. in June, followed by 20 in July, 34 in August, 27 in September, 29 in October, 17 in November, and 20 per cent. in December. In the first half of the year freight earnings were:

	1893.	1892.	Dec.
Jan. 1 to June 30	$2,161,472	$2,162,640	$1,118

That is, there was substantially no change. Contrast this with the freight earnings in the last half year:

	1893.	1892.	Dec.	P.c.
July 1 to Dec. 31	$2,111,645	$2,820,957	$709,312	25.1

One will probably have to search in vain in the annals of the company to find another year when the freight earnings were no greater in the last half than in the first half of the year.

We see by this how very important the World's Fair travel was to this, as it was to most of the Chicago railroads. It came just at the time when it was most needed.

A Defective Calculation of the Horse Power Required for Rapid Transit Trains.

In the February number of *Electrical Engineering* a writer under the title of "Calculations on the Horse Power Required for Rapid Transit Trains," reaches conclusions that are misleading and inaccurate. The most elementary case of acceleration is assumed, viz., a case where the drawbar pull is constant during the period of acceleration. This assumption makes the formulas very simple, but of course useless. It is assumed that "it is found from experience that the horizontal effort cannot be depended on for more than 20 per cent. of the weight on drivers where the axles of the drivers are independent, and in most cases much less than this; in fact, as low as 15 per cent." This drawbar pull is taken as the basis of calculation for acceleration. The fallacy is apparent. The drawbar pull for all motors, so far as known, whether electrical, pneumatic or steam, varies from a maximum at starting to a minimum at full speed, the variation being fully 75 per cent., and the acceleration varying accordingly.

On the basis of the erroneous assumption the very simple formula

$$S = \frac{V^2 - V_0^2}{2f}$$

is reached, in which V is the final velocity at the end of a given distance denoted by s, V_0 the initial velocity and f the assumed acceleration based on a constant drawbar pull equal to 15 per cent. of the weight on drivers. The resulting velocity curve corresponds with that given by the force of gravity acting on a free body and is not the curve of velocity of actual trains.

It is said that "likewise the time-velocity curve" can be "traced" in the same way. Such a time-velocity curve would be a straight line such as is given by the action of gravity on a free body. Evidently the writer did not have much confidence in his formulæ, as he adds the following curious paragraph, which should be a warning to those who attempt to follow the method outlined. The m referred to in the quotation is the total weight on the driving wheels.

"It will probably be found that after tracing in both curves that they do not agree; that is, that the intersection of the acceleration and retardation distance-velocity curves is not at the same height as the intersection of the time-velocity curves, but may be above or below it. In case the intersection of the distance velocity curves is below the intersection of the time-velocity, the average acceleration is too great, and *vice versa*. In case the average acceleration is too great, the curve should be laid out, starting with the maximum acceleration allowed by traction as determined above, and should be continued at this acceleration for a distance; the acceleration should then be gradually dropped to zero. This process should be continued, making curve after curve, until finally the intersections of the two sets of curves are at the same height. When this has been accomplished the resulting curve will represent the probable motion of the train. If the comparison of the heights of intersection is such as to indicate that the acceleration is not large enough, the weight of the motor car has been assumed to be too small, and m must be increased accordingly."

Next the stored energy in the train at the maximum speed is divided by the total time from the start at one station to the time of starting from the next station, and the result is called "the average number of foot pounds used." This is so far wrong as to need no explanation. Then is added together the stored energy of the train at the maximum velocity, the frictional resistance, and the stored energy in the car wheels; the sum is the total energy. This total is divided by the "estimated average efficiency of the motors and controlling apparatus," and again divided by the time from start to start and by 33,000, and the result is declared to be "the average horse power consumed during the entire run." The error in this is apparent, as the horse power curve is not a straight line, but a decidedly varying one, whether taken on a time or a distance basis. The assumption that "the estimated average efficiency of the motors and controlling apparatus" should be used as just described, is wrong. The final error, which is worst of all, is in the statement that "the actual horse power consumed at any one point in the run" can be calculated on a basis of uniform drawbar pull.

We call attention to this article, as it is misleading and does not correspond with the facts. See *Railroad Gazette*, 1892, page 560, and 1893, pages 51 and 210.

January Accidents.

Our record of train accidents in January, given in this number, includes 41 collisions, 69 derailments and 6 other accidents, a total of 116 accidents, in which 44 persons were killed and 129 injured. The detailed list, printed on another page, contains accounts only of the more important of these accidents. All which caused no deaths or injuries to persons are omitted except where the circumstances of the accident as reported make it of special interest.

These accidents are classified as follows:

Collisions:	Rear.	Butting.	Crossing and other.	Tot'l.
Trains breaking in two	3	0	0	3
Misplaced switch	1	0	2	3
Failure to give or observe signal	4	0	1	5
Mistake in giving or understanding orders	0	4	0	4
Miscellaneous	1	1	10	12
Unexplained	4	5	5	14
Total	13	10	18	41

Derailments:			
Broken rail	7	Misplaced switch	9
Loose or spread rail	2	Engine left unattended	1
Defective bridge	1	Derailing switch	1
Defective switch	1	Animals on track	1
Broken wheel	3	Landslide	3
Broken axle	5	Snow	1
Broken truck	1	Malicious obstruction	6
Broken drawbar	1	Unexplained	23
Broken brakerod	1		69
Broken car	1		
Boiler explosion	1		

Other Accidents:	
Boiler explosion	2
Cylinder explosion	1
Cars burned while running	1
Heater explosion	1
Other causes	1
	6
Total number of accidents	116

A general classification shows:

	Collisions.	Derailments.	Other acc'd'ts.	Total.	P.c.
Defects of road	0	11	0	11	9
Defects of equipment	3	13	4	20	17
Negligence in operating	24	11	1	36	31
Unforeseen obstructions	0	11	1	12	10
Unexplained	14	23	0	37	33
Total	41	69	6	116	100

The number of trains involved is as follows:

	Collisions.	Derailments.	Other acc'd'ts.	Total.
Passenger	20	27	4	51
Freight and other	57	46	2	105
Total	77	73	6	156

The casualties may be divided as follows:

	Collisions.	Derailments.	Other accidents.	Total.
Killed:				
Employees	5	10	1	16
Passengers	20	2	2	24
Others	4	4	0	4
Total	29	16	3	44
Injured:				
Employees	18	28	3	49
Passengers	55	16	3	74
Others	6	0	0	6
Total	79	44	6	129

The casualties to passengers and employees, when divided according to classes of causes, appear as follows:

	Pass. killed.	Pass. injured.	Emp. killed.	Emp. injured.
Defects of road	0	5	6	9
Defects of equipment	2	6	3	6
Negligence in operating	21	55	5	23
Unforeseen obstructions and maliciousness	0	0	1	4
Unexplained	1	8	1	7
Total	24	74	16	49

Seventeen accidents caused the death of one or more persons each, and 29 caused injury but not death, leaving 70 (60 per cent. of the whole) which caused no personal injury deemed worthy of record.

The comparison with January of the previous five years shows:

	1894.	1893.	1892.	1891.	1890.	1889.
Collisions	41	104	120	106	76	45
Derailments	69	157	117	93	89	72
Other accidents	6	12	12	12	6	7
Total "	116	273	249	211	171	124
Employees killed	16	38	46	38	52	25
Others "	28	11	15	8	15	10
Employees injured	49	170	111	118	123	75
Others "	80	159	152	92	104	38
Passenger trains involved	51	105	109	79	67	40
Average per day:						
Accidents	3.74	8.81	8.03	6.81	5.52	4.00
Killed	1.42	1.58	1.97	1.48	2.16	1.13
Injured	4.16	10.61	8.48	6.77	7.32	3.65
Average per accident:						
Killed	0.379	0.179	0.245	0.218	0.392	0.282
Injured	1.112	1.205	1.056	0.995	1.339	0.911

The extreme dullness in railroad traffic which was shown in the accident record for December again appears in a marked way in January, the number of accidents being much smaller than for any month during the past five years and smaller than in any winter month for seven years. The number of employees killed is smaller than for any month in the past seven years except one (April, 1890).

The worst accident of the month, that at Hackensack River, near Newark, N. J., has already been reported. This is another instance of a bad accident in a state which does not investigate and publish the causes of such disasters. As far as the main cause is concerned, the lack of a competent investigating authority is not particularly felt, for the circumstances were clear, and the force of public opinion alone seems to have operated with remarkable effectiveness; the road has already ordered the introduction of the block system. But there is still a question concerning which further light is needed, and that is the construction of the cars. The completeness of the wreck seems to indicate that either the cars were weaker than good judgment dictates or else the speed of the train that smashed them was high, instead of moderate, as was claimed.

The coroner's jury which investigated this accident blamed the brakeman of the foremost train and laid no censure on the engineman of the following train. While it is not likely that this verdict is based on any very accurate or scientific estimate of the behavior of these two men, the conclusion arrived at is probably the same that would have resulted from a careful comparison of the acts of the two men in the light of the technical requirements of their respective instructions. Under the time-interval system the prevention of rear collisions depends chiefly upon the engineman and the brakeman, and when it comes to a fine point in a doubtful case the brakeman must take the larger share of the responsibility. It would be impossible otherwise to run trains at any speed.

Five other accidents caused the death of one or more passengers each. Two of these, Linwood, Kan., on the 2d, and Henderson, N. C., on the 26th, were rear collisions, which demand as searching an investigation as any accident of the kind ever did, and they ought to receive the condemnation of public sentiment as severely as the Hackensack case. But neither case was so located as to be subject to the concentrated fire of a dozen newspaper batteries, and in both cases one of the trains involved was a freight train. It is just as easy, however, to keep freight trains apart, as passenger trains, by the block system. In the Linwood case the coroner's jury censured the Rock Island train. The killing of two passengers by the explosion of a heater at San Marcos, Tex., on the 24th, is a matter of interest to all operating officers, but as yet we have been unable to learn anything about the specific causes, more than has appeared in the daily papers.

The most curious accident of the month, to our younger readers, will be that on the Southwestern of Georgia, on the 25th, where an engine was derailed and overturned by striking a "snake-head." It appears that the old strap rail, light iron bars spiked to longitudinal wooden stringers, is still in use down there, and so they have the old-fashioned name for a loose rail.

A locomotive struck a street car in Washington, D. C., on the 7th, and there was a similar case in Elizabeth, N. J., on the 29th. At Buffalo, on the 12th, a steam fire engine was wrecked, and its driver killed, by a locomotive at a street crossing. Three persons in a wagon were killed by a locomotive at Edwardsburg, Mich., on the 6th, three at Findlay, O., on the 20th and three at Fall River, Mass., on the 31st. At the latter place there was a gateman on duty, but the electric bell on which he depended for notice of the approach of trains was out of order and he did not close the gates in season.

Accidents on logging roads, and other such lines, occurred near Stephens, Ark., on the 20th, near Weston, W. Va., on the 10th and near Birmingham, Ala., on the 11th, killing 9 persons altogether. Electric street cars ran into each other in Philadelphia on the 2d, in Brooklyn, N. Y., on the 10th, in South Orange, N. J., on the 17th, in Brooklyn on the 21st and in Boston on the 29th. The number of persons seriously hurt in these five cases was 8 or more. In Easton, Pa., on the 23d and in San Francisco on the 27th, electric cars ran away, and over a dozen persons were injured in each case.

The canal across the lower peninsula of Michigan to Lake Erie has broken out again, in the newspapers, as it does periodically. The newspaper engineer casts his eye on the map and sees that a vessel from Chicago to Buffalo having to go 225 miles due east to reach Lake Erie, begins by sailing 250 miles north, and has gone about 700 miles before it enters Lake Erie. This frightful waste is not to be endured, and a canal across the peninsula is at once designed. But when an investor comes to consider the subject, he finds that unless his canal were made for vessels drawing 18 ft. those which carry at least cost would have to transfer their cargo at each end of the canal, at a cost fully as great as the ordinary freight, not between Chicago and Lake Erie only, but between Chicago and Buffalo; and that if the canal were of sufficient depth, unless of an entirely impracticable width, it would cost very much more for a steamer to go through than to steam around by Mackinaw; and several times as much as they get for their cargo for the towage of sail vessels; so that, if a canal existed it would probably be used almost exclusively for local purposes. The fact is, that lake freight between Chicago and Buffalo doesn't need any cheapening. The average on grain is probably less than 2 cents a bushel, and on coal going up, 40 cents a ton. And the adoption of very large vessels of modern types tends to reduce even these rates. Deep harbors and maintenance of a deep and safe channel through the St. Clair flats will do more toward cheapening lake transportation than any possible canal could. There is no transportation in the country which needs cheapening less than that on the great lakes between the deeper harbors.

The Delaware, Susquehanna & Schuylkill has made a contract with the Lehigh Valley by which the freight trains of the former will run over the road of the latter to Jersey City, thus giving the Lehigh Valley the benefit of a share in the profit on practically all the coal shipped to New York Harbor by Coxe Brothers & Co., who are the owners of the Delaware, Susquehanna & Schuylkill. It is said that the contract runs for 15 years and guarantees that at least one-third of all the coal sold by Coxe Brothers shall go over the Lehigh Valley; and that it will include nearly a million tons a year. The lines controlled by Coxe Brothers extend to a dozen different important mines in the Hazleton and Beaver Meadow territory, and it is expected that this contract will tend to prevent the building of competing railroads into that territory. Two or three years ago, when Coxe Brothers were dissatisfied with the rates made by the Lehigh Valley for the transportation of their coal, they entered suit against the road, claiming large damages, and this suit has been pending ever since, but it is said that now it will be dismissed. Soon after this suit was commenced Coxe Brothers & Co. organized the Delaware, Susquehanna & Schuylkill Railroad, and built it in 1891 and 1892. An agreement was made with the Philadelphia & Reading by which that company built a connecting branch of 10 miles, and all the coal controlled by the firm and destined for New York Harbor was sent over the Reading. This contract was abrogated by the Reading Receivers a few months ago. The railroad comprises about 40 miles of main track and connects with the Pennsylvania at Gowen, its Western terminus, with the Lehigh Valley at Oneida Junction, at Lumber Yard, and at Stockton, and with the Central of New Jersey at its Eastern terminus.

Mr. McLeod's testimony in Philadelphia last week did not add anything new to our knowledge of the rise and fall of the Reading combination, though he gave a clear statement of his theory. When made President of the Reading he found the company paying $4,000,000 interest yearly on coal lands owned but not worked. He saw no hope for the stockholders except by widening his markets and supporting the prices of coal. His lease of Lehigh Valley and Jersey Central was to promote harmony and advance prices; in this he succeeded. Then he thought he could sell more Reading coal by controlling the New York & New England and the Boston & Maine, but here he came into antagonism with stronger men. His operations in New England lost the Reading large sums and were arbitrary and wrong. Had he allowed his first plans time to mature and not tried to accomplish in a few months, by borrowing heavily, what ought to have taken years, he might have built up a prosperous coal trade. His extended and unlawful speculations with his large floating debt wrecked the plan. What Reading needs now is not a losing fight over New England trade so much as profit on the coal she mines. The Reading in twenty years will have coal in plenty when other regions are showing signs of exhaustion.

The two literary societies of the Wisconsin State University are accustomed to have a joint public debate yearly, which is a not uncommon custom in other colleges. But what is uncommon is the thoroughness with which the debaters investigate the subjects, judging by the last debate, which was on no less a question than this: "Would national ownership and operation of the railroads in the United States be preferable to ownership and operation by private corporations?" This debate was held Jan. 19 last, the debaters having had the subject under study, we are told, for nearly a year previous. A full report of the debate is given in the university newspaper, *The Ægis*, of Feb. 2, which also gives a bibliography of the works which had been "used and found serviceable" by the debaters, which bibliography is our chief reason for calling attention to the debate. It contains more than 250 titles, about nine-tenths of which, we should say, are of English publications. The research which this indicates may, we imagine, be credited largely to the methods of study inculcated by the Professor of History and Political Economy, Dr. Richard T. Ely, late of Johns Hopkins University. Whether the results in this particular debate were of importance or not, this thorough method of investigation is of very great importance, and deserves imitation by these young men's gray-headed fathers and grandfathers, some of whom have not hesitated to legislate on similar questions without taking the trouble to learn anything about them. The debate was held on the assumption that the railroad system of the country could be acquired for not more than $6,000,000,000 and that all government officials and employees should be appointed and promoted upon a basis of business efficiency only. The judges decided unanimously for the negative, which of course expresses their opinion on the merits of the arguments offered, not necessarily on the question itself.

The accident report of the British Board of Trade for the nine months ending Sept. 30 last has just been published. It shows 17 passengers and 7 employees killed, and 410 passengers and 56 employees injured, by train accidents for the time covered by the report. The principal accident was a derailment on the Taff Vale Railroad, Aug. 12, near Llantrissant Junction, which was briefly reported in the *Railroad Gazette* at the time. This was a disastrous wreck, the cars falling down a bank and 12 passengers being killed. The Inspector, Major Marindin, finds that the accident was due to the fracture of the hanger of an under hung spring, which hanger was in the shape of a T link. The spring dropped far enough for the bottom of the buckle to strike the inside jaw of a chair in the track with such violence that the spring pillars were broken and the spring fell upon the roadway, derailing the first car. The inspector finds no fault with the construction of an engine with springs thus unprotected by safety hangers, and devotes a good portion of his remarks to a discussion of the behavior of the engineman, who, seeing the car next to the tender off the rails, decided not to apply the brake. The runner is not blamed, but his judgment is declared defective. In the old days, when there were no brakes on English trains, except on the engine and the hind car, the cautious habit of not applying brakes when a derailment occurred became very general, but the inspector reminds enginemen that those days have gone by; that when they have a continuous brake, acting on the whole train, they should apply it at once in case of derailment.

The wheat exports of India are given in the government report on the railroads of that country as follows, for ten years:

Year.	Bush.	Year.	Bush.
1883	41,488,840	1888	29,595,925
1884	26,127,285	1889	27,559,168
1885	41,257,661	1890	25,544,608
1886	42,615,552	1891	52,498,208
1887	27,484,688	1892	31,593,141

This shows no tendency to increase: the average in the first five years being 35,800,000 bushels; in the last five, 33,960,000. And the report of the total India wheat crop given in the same document shows no increase, but rather a decrease, the production of the last five years having been 10 per cent. less than that of the first five, and in none of the last five equaling the *average* of the first five. Naturally, considering the immense population, only a small proportion of the Indian wheat is exported; for the ten years less than 14 per cent. of the total production. The chief food of the country as a whole being other grain (rice), as may be known by the fact that the wheat production is less than a bushel per inhabitant, the amount of any crop exported does not depend so much on the production of wheat in the year as on the production of all breadstuffs. The export of 52½ millions was made after a crop of 256 millions, while in 1885, after a crop of 294 millions, only 41 millions were exported.

NEW PUBLICATIONS.

Transactions of the American Institute of Mining Engineers.

The advance sheets of the Transactions of this society are at hand and they include papers upon the following subjects: Recent Advances in Pyrometry, by W. C. Roberts-Austen, of London; Some Experiments for Determining the Refractoriness of Fire Clays, by H. O. Hofman and C. D. Demond, Boston; The Growth of American Mining Schools and Their Relation to the Mining Industry, by Samuel B. Christy; The Genesis of Ore Deposits, by F. Posepny, Vienna; Product and Economical Results of the Marsac Refinery, by C. A. Stetefeldt; The Bessemer Process as Conducted in Sweden, by Prof. Richard Akerman, Stockholm; The Cerro De Pasco Mining Industry, by Otto F. Pfordte; The Franklinite Deposits of Mine Hill, Sussex County, N. J., by Frank L. Nason; Survey of Underground Connection at Leavenworth, Kan., by Edwin A. Sperry; Notes on the Unwatering of a Flooded Mine and on the Permeability of Natural Strata to Air, by Beverley S. Randolph; Notes on the Re-Working of Anthracite Culm Banks, by Arthur W. Sheafer; The Determination of Phosphorus of Coal and Coke, by Jacob Lychenheim; Note on Certain Magnetic Phenomena in Gold-Bearing

Slates, by C. A. Mezger; Improved Slag-Pots, by H. A. Keller; The Bertha Zinc Mines, by W. H. Case; The Separation of Blende from Pyrites, by W. P. Blake; Note on Experiments on the Specific Gravity of Gold Contained in Gold-Silver Alloys, by Henry Louis, Singapore; The Consumption of Fuel in the Taylor Gas Producer Plants, by C. A. Stetefeldt; Ore Washer at Longdale, Va., by Guy R. Johnson; Geological Distribution of the Useful Metals in the United States, by S. F. Emmons; Review of American Blast Furnace Practice, by E. C. Potter; General and Special Observations Concerning Ore Dressing, by Oberbergrath O. Bilharz, Berlin; Mine Explosions Generated by Grahamite Dust, by William Glenn; Blowing Engines, by Julian Kennedy; Summary of American Improvements and Inventions in Ore Crushing and Concentration and in the Metallurgy of Metals, by James Douglas; The Limitations of the Gold Stamp Mill, by T. A. Rickard; The Open Hearth Process, by H. H. Campbell; Solids Falling in a Medium, by F. M. F. Cazin; The Stetefeldt Furnace, by C. A. Stetefeldt; The Origin of the Gold-Bearing Quartz of the Bendigo Reefs, Australia, by T. A. Rickard, and The Physics of Steel, being a report of the discussions and contributions by members on papers presented upon kindred subjects at the International Engineering Congress.

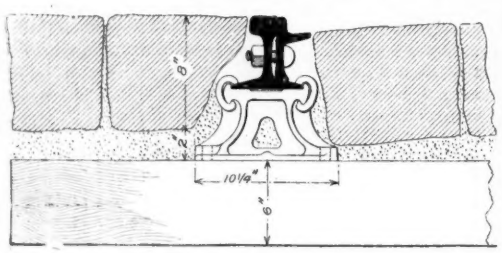
English Methods of Street Railway Track Construction, by James Moore and Alex. McCallum. New York: Street Railway Publishing Co., 1894. 26 pages, 6 by 9. Price 35 cents. Illustrated. This pamphlet gives the processes and methods of construction of street railroad track in England. It shows not only the track, but the substructure, including the concrete paving and surfacing, together with numerous types and patterns of rails and joints. Two pages are given to a criticism of American construction of street tracks in which the differences between the practice of the two countries is pointed out.

TRADE CATALOGUES.

The Page Belting Company, Concord, N. H., has recently issued a catalogue entitled *After the Fair*, it being a 25th anniversary souvenir of the founding of the Page company. It gives many illustrations of the machinery and testing machines operated at the World's Fair by Page belting, with descriptions of the different styles of belting and their special features, also the velocity, length, width and dimensions of the largest of these and the amount of work they have done. The catalogue illustrates the quarters of the company in 1868 and the present immense manufactory at Concord, N. H., which is required to supply the present trade.

Cost of Track in a Paved Street.

In our issue of Jan. 26, page 62, we published a description of a piece of track laid in a street at Syracuse, N. Y., by the New York Central & Hudson River road, the peculiarities of which were a tram-rail, to make the



New York Central Track in Washington Street, Syracuse.

flange-way passable for horses and wagons, and cast iron chairs to support the rails 5 in. above the sleepers. Since then Chief Engineer Katte has given us figures showing the cost of the track, not including paving, which are as below. The sums given are the exact cost of the work laid in Syracuse last year, but with the reductions which have since taken place in the market prices of iron and steel, it is concluded that the cost to-day would be fully $950 a mile, or about 7 per cent. less.

Cost of one mile—Single track.

125⅔ tons steel rails (80 lbs. per yd.) at $29.65 per ton	$3,721.24
Drilling extra bolt holes in rails	344.95
47 tons tram-rail (30 lbs. per yd.) at $50.90 per ton	2,592.30
11,000 lbs. splice bars, 2 cts. per lb.	220.00
4,576 bolts and nuts, 3⅛c. each	146 43
8,450 lbs. track spike, 2⅓c. per lb	197.17
5,632 cast iron raising chairs and malleable clips at 50c. each	2,816.00
2,816 yellow pine cross ties at 55c. each	1,548.80
1 mile labor, tracklaying, lining and surfacing and ballasting, at 40c. per ft.	2,112.00
Total	$13,498 90

Summary.

5,280 ft. materials at $2.15⅞ per ft.	$11,388
5,280 ft. labor at 43c. per ft.	2,112
Total	$13,500

Cost of one switch and frog complete.

1 Duggan switch, including raising chairs, lever and c. i. box for same, complete	$150
1 No. 10 frog, 80 lb. steel rail, with raising chairs	63
Track rails between switch and frog	45
Labor, laying	62
Total	$320

Causes and Cure of Hot Boxes.

At the last meeting of the New England Railroad Club, held in Boston Feb. 14, the above subject was discussed, the opening address being by Mr. F. D. Adams. He said: The causes of hot boxes are various. First, excessive load. If we get too great weight upon a certain amount of bearing surface the friction produces heating. In old times the journals were very small. They have grown gradually larger. When they arrived at about 3¼ in × 5 in. it was supposed that they had been made abundantly large. In the Master Car Builders' Association we had quite a war of words in order to get the size of journals increased. Finally, by a compromise, we succeeded in getting adopted by the Master Car Builders' Association the 3¾-in. × 7-in. journal. The mistake made at that time was that we did not get it larger. Since that time there has been a further increase of the size, but many old cars are in service and our freight men often load them without regard to the size of the journal, so that the hot box is no uncommon thing. The journal adopted for the present freight car is 4¼ in × 8 in

Brasses often are put in that are too rough. The style of brass that was adopted by the Association at first with the 3¾-in. × 7 in. journal, and I believe generally the same style of brass is adopted for the 4¼-in. × 8-in., is an octagon back. I have found in many cases—and this is certain to make a hot box—that the key was too narrow on the edge; in other words the bearing was upon the edge of the key and not upon the back of the brass, preventing proper distribution of oil.

Another source of hot boxes is a very simple thing, improper packing. Many journals run hard, because waste is packed so hard into the back part of the box that no oil will pass through it. The oiler comes along and looks in; it is a little dry; he jams in some waste, turns in a little oil and calls it all right, bnt the rear part of the box will be perfectly dry, and within ten miles the journal will be hot. Occasionally, by the jolting of the car, the brass will rise a little off the journal; just at that moment it may catch a string of waste and draw it over the top of the journal, which, remaining there, will cause a hot box.

Perhaps the principal difficulty in all trouble with hot boxes is dirt and grit getting into the boxes. The old style of dust guard is often loose even when new, but when quite tight, they will soon wear. Even if the front is tight, dirt and grit constantly work into the box through the back packing. If the box can be made so as to keep the dirt out absolutely, if it is properly oiled and well fitted, if the load is adapted to the bearing surface, and if the journal is of the proper size, there need be little trouble with hot boxes. In the Western Railway Club, Mr. Waitt, of the Lake Shore, reported that on that road there were in passenger equipment 54 hot boxes a month and 1,100 freight. I suppose they were not all red hot, but warm enough to be called hot boxes. It seemed to me that that was an enormous number, so I made some comparisons with our own cars. The Lake Shore was making about double the mileage on passenger trains that we were. That would subject us to the necessity of having, in the same proportion, 27 or more hot boxes. I found that we had on the Boston & Albany for a year only 25, two a month.

Two or three years ago Brother Lauder made some elaborate tests as to the waar of journal brasses, and he came forward here with the statement that 1,200 miles was considered good wear for an ounce of brass. It excited my curiosity a little, and I went home and weighed 160 brasses, and took the average of the 100 for weight of a new brass. Then I weighed a good many brasses that I had taken out, where I knew what the mileage was, and I found we were making about 3,000 miles to the ounce, which was more than double his figure. We are making on an average, for our passenger trains, about 3,500 miles to the ounce of wear. I did not look after the freight cars, as it is very difficult to keep track of them.

I have here some sample brasses. The mileage is marked on each. One brass on which the lead is not worn out has run 75,000 miles. Another one that ran on the same side of the car has worn off just 16 oz. Another one that ran on the other end of the axle is worn more, though of course it made the same number of miles. It wore off 22 oz. The brasses are different makes. Another brass that has made 194,000 miles is not more than half worn out. It will make 40,900 or 50,000 miles more easy enough. The average wear of our brasses in passenger trains is about 145,000 miles.

I took pains to find out the exact number of hot boxes reported on our road for a year, both freight and passenger, and I found we had 546. I won't say that there were not other boxes not reported. Of that number 82 were on passenger trains: 25 of them were on our own coaches, and 25 were on the Wagner sleepers. There are but few Wagner sleepers compared with the coaches on our road. The balance, 32, were on New York, New Haven & Hartford cars. The average miles run to each hot box would be 480,000 miles.

The best way to remedy hot boxes is, in the first place, to have a tight oil box; make it tight at the back end, and you won't get dirt into it. Use good oil, and have the box properly packed with good waste. I am not much in favor of new lubricators, patent fixtures, springs, etc. . . .

DISCUSSION.

Mr. LAUDER (Old Colony): I believe with Mr. Adams that a dust guard that will absolutely prevent dust from getting into the box is the surest reliance for freedom from hot boxes. It is difficult to eliminate this trouble. There have been a great many plans proposed for so-called dust guards. But I suppose that almost all the cars running have the old-fashioned dust guard of 40 years ago. Mr. Adams, as I presume most of you know, has designed, and I believe patenteda dust guard.

A set of axles were put under a car of ours, the journals being fitted with the Bemis box, which excludes perfectly (Mr. Adams', I presume, does it equally well). This car, running through the wilds of Cape Cod, where dust is plenty, wore out four pairs of wheels with one axle; and after having worn out four pairs of chilled wheels, running at least 200,000 miles, three of the journals out of the eight had lost in their diameter less than $\frac{1}{64}$ of an inch. Now with the ordinary Master Car Builders' standard 3¾-in. × 7-in. journal, with the Master Car Builders' standard brass and appliances, on Cape Cod, I have removed wheels from under the car because the journals had worn before they had worn out one pair of wheels. The length of wear made was entirely due, in my judgment, to the exclusion of the dust.

Hot boxes have increased as our weights increased, both passenger and freight. About a year ago I designed and built a locomotive for heavy work and high speeds. The locomotive weighed, with water, about 58 tons, without the tender. The larger proportion of the weight being carried by four journals, I put in a 9-in. diameter driving wheel journal. That engine in fast service has less heating of the driving boxes than any engine we own, notwithstanding she weighs some eight or nine tons more. I find the same with crank pins on locomotives. The larger the pin; the larger the bearing surface, especially in its diameter, I find the easier it can be maintained without heating. A curious thing I have noticed is that lengthening the journal does not have the effect of preventing heating that enlarging it in its diameter does. Dust is a prolific cause of disaster to the locomotive. In double headers, the forward engine rarely heats or gives trouble; the rear engine is almost invariably hot. The front engine kicks up a dust and the rear engine gets the dust. A remedy for this is to use oil freely. The quality of the lubricant makes little difference in a car box where packing can be used and where dust can be excluded, but in exposed places heavy lubricants should be used.

The material for journals also enters into the matter. I believe that steel is the proper material for axles. It is perfectly homogeneous, always free from seams and other imperfections, and will wear longer and with less liability to heat. In the use of iron axles, the small seams develop. They are created when the axle is manufactured, by reason of slag or other things getting into the pile and preventing a perfect weld. It is impossible to discover these little seams. After a journal has been run and been heated, an examination will reveal them. These little seams may be found in crank pins. It may be cured by chipping a little groove, and taking the seam out, and carefully tinning it over and filling with Babbitt metal.

With steel you get over that difficulty, but you run into another. Steel is so fine in its texture that it does not lubricate as well as iron. My observation is that steel axles, or a steel crank pin, will heat quicker than an iron one. A reason given is that the material is so much finer that the little cells will not hold the lubricating material. Glass has no cells; a glass journal cannot be lubricated. Many of the best mechanics prefer iron, and a large majority of the best railroad mechanics we have prefer steel.

Mr. ADAMS: I believe that lengthening the journal does just as much good as to increase the diameter. The length and the diameter should be increased to keep the proper proportion. We have 2,000 cars running with 4½-in. journals; and it is a rare thing that we have a hot box. There is no spring to the axle. If a journal gets red hot and a pail of cold water be dashed upon it it will invariably crack, and it will break off in service.

Mr. LAUDER: As to this question of water on hot boxes, I don't take any stock in it. I don't think that is what breaks the journal. The journal is cracked by running when it is hot, with its immense weight. A journal that is run till it is red hot must necessarily spring badly, and that is what carries a little fracture all around. If the box is jacked up so as to take the weight off the journal, I can see no reason why cooling the journal off with cold water should harm it if it is not already cracked. It is dangerous to run a journal that has been anywhere near red hot. A journal that has been red hot should be removed at the earliest possible moment to avoid disaster.

As to the proper proportion between length and diameter. If the axle is made large enough so that it won't spring, either between the wheels, or in the journal, possibly lengthening the journal and increasing the bearing surface in that way would have a good effect. When springing takes place the outer end of the journal droops, and consequently brings a larger percentage of the weight on the end of the journal next the wheel. The large journal must be supplemented with a large axle.

Mr. WALDO: We have made a study of lubricants in connection with bearings, because it seemed that the question was not a mechanical and physical question wholly, but also a chemical question. In looking up the literature on the subject we found that Mr. Isaac Babbitt had received a gold medal from the Massachusetts Mechanics' Charitable Association in 1841, and a grant from Congress of $20,000 for his discoveries.

Referring to the lining of brasses, called lead, if you put an ordinary lubricant on it, the ordinary lubricant generally contains an acid or something which will have a reactionary effect upon this bearing. A surface is at once raised which is hardened and hammered, the dust is pulverized through it, and you have a condition existing between the surfaces which immediately generates heat. The amount of friction in a box has nothing whatever to do with the area of the surfaces; that merely indicates the distribution of this friction. Unfortunately, people who buy these bearings for cars ask, "What is the price?" And inasmuch as metals which have high-resisting compression strain and good frictional qualities at the same time are high priced, they buy the increased amount of metal used to shorten the life of the metal, and go directly away from the practice of Mr. Isaac Babbitt, and make their journal large, so they can use a poor material for bearing surfaces. You are going directly away from good practice, and simply looking in the direction of the first cost.

It is possible to avoid heating, to lessen your friction, and to run a box cool, but it can only be done by having a proper appreciation of the mechanical facts which exist in the box, and by having a lubricant which is not constantly dissolving off a part of the brass and is not altering the surface. On lead the action of acid is to fatigue the surface, change the character, and it becomes gritty from the dust, and your brass is perfectly useless to resist friction.

Cast iron is undoubtedly one of the very best bearing metals known, and for the reason that it is not acted on chemically, it is not changed by the hammering of the axle into a new form, and it is porous enough to hold a good lubricant in suspension. Therefore it is a very good bearing metal indeed. But the best bearing metals known are the phosphor bronzes, in which lead is held in mechanical suspension. I was told the other day that it was impossible to buy genuine Babbitt metal. I sent out and bought 40 samples of metal marked "Genuine Babbitt." It was bought in every part of the country from New Orleans to Portland. Of the entire 40 there was one sample which, by a stretch of courtesy, could be called genuine Babbitt; I mean that described by Isaac Babbitt in 1839. The mechanical builders of this country are not familiar with genuine Babbitt. Mr. Babbitt in his original patent used 50 parts of tin, 5 of antimony and 1 of copper. The disadvantage of introducing any lead whatever in a soft bearing is that the metal has no compression strength.

Mr. ADAMS: The theory of most of the railroad mechanics at the present time is that a bearing lined with lead makes it somewhat self-adjusting. That was probably the original object of lining with lead. If a hard bearing be put in, it bears only at the ends. The result is, it gets hot right off. A bearing lined with a thin piece of lead adjusts itself immediately according

to the pressure, and consequently it runs without any difficulty.

If the oils are so destructive, how is it possible to make such mileage as we do? Many run 30,000 and 35,000 miles before they are worn through lead $\frac{1}{16}$ of an inch thick. I have a bearing here which is said to be lined with lead. It has made 75,000 miles to my certain knowledge and the lead is not destroyed. If the acids in the oils destroy the lead, increase the friction, how is it that they run so well without getting hot?

Mr. WALDO: I spoke particularly of boxes for high speeds and high pressures, such as the boxes of engines

Mr. ADAMS: I should like to inquire if the passenger cars do not go just as fast as the engines do?

Mr. WALDO: But the pressure is nothing like it.

Mr. ADAMS: That is true, but we have some that weigh 50 tons.

Prof. C. FRANK ALLEN: Mr. Lauder said that cheap lubricants might cost less, but that when the wear of the journals was considered the total result would not be a saving. That is all right as far as he went, only he didn't go far enough. If you are heating boxes, and if you are wearing down your journals in doing it, it will cost something to do that. In other words, you are spending money every day in the week, all through the year, in overcoming friction that you ought not to overcome.

Mr. JOHN COGHLAN: I was interested in lead lining and its effects on the journal. I had a car whose bearings had $\frac{1}{16}$ of an inch lead lining; when taken out, the lead lining was just barely worn through. The mileage of the car was 56,500 miles, and the weight of the car, wheels and all included, is 49,000 lbs. The journal had worn less than $\frac{1}{32}$ of an inch in diameter. If the effect of oil is so great upon the lead, it would be impossible to have that car run that time without some injury to something. It has proved the efficiency and the economy of using a good lead-lined bearing. I also made an experiment in reference to the increased length of the journal and the diameter of the axle which consisted of taking an ordinary sized M. C. B. bearing and reducing it 25 per cent, and putting it under a car that had always been running cool before; the consequence was we could not keep it cool. It would not run 10 miles without getting hot on account of that reduction of 25 per cent. Afterward I put back the original full sized journal, and we never had any trouble.

The discussion was then declared closed.

The subject for the next meeting will be an address by Mr. Twombly, of the Old Colony, on "Incidents in Mexico." A nominating committee was appointed to recommend candidates for officers of the Club for the ensuing year.

Gibbs' Interlocking for Electric Street Railroads.

The rapid increase in the use of electricity as a motive power for street railroads has emphasized the need of more efficient crossing protection than that afforded by the vigilance of a motorman or the bar of the ordinary crossing gate. The reasons for increased danger at crossings with electric street railroads over those with horse car lines lie in the greatly increased speed of the cars on the former, their great weight and consequent inertia, and the liability of failure of their source of power by blowing out of fuses, jumping off of trolley wheel by jolting over rough crossing frogs. The necessity for applying the same regulations for the crossing protection of such roads as are now required by state laws in cases of steam roads is apparent.

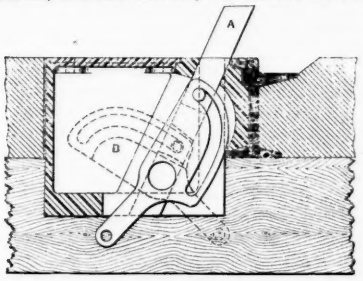


Fig. 2.

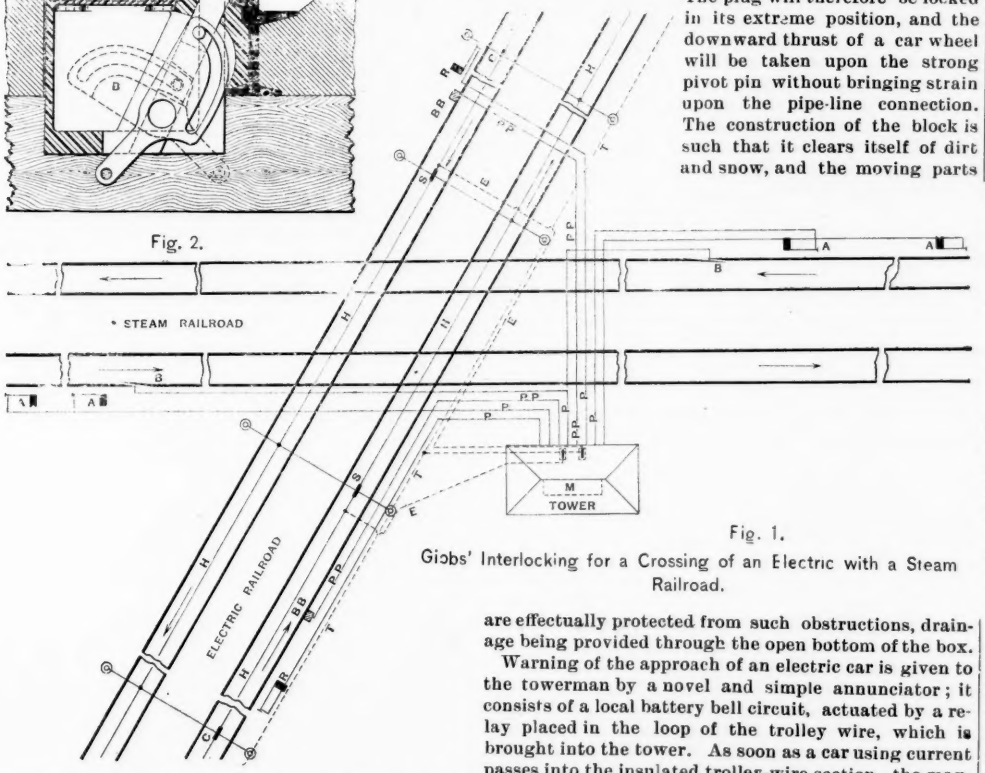


Fig. 1.

Gibbs' Interlocking for a Crossing of an Electric with a Steam Railroad.

The devices shown in the accompanying illustrations are the invention of Mr. George Gibbs, Mechanical Engineer of the Chicago, Milwaukee & St. Paul Railway, and consist of a Saxby & Farmer or other mechanical interlocking machine, so combined with the electric line as to enable the towerman to cut off the current from the electric cars when necessary to block the line and thus make it impossible to move cars in disobedience of the signals. A derailing device is also provided to be operated in paved streets to prevent cars from coasting onto or over crossings. This is of such a nature that it offers no obstruction to street traffic, and is quite free from liability to clog up with mud, snow or ice. It is apparent that the ordinary form of derailer employed on steam roads would not fulfill these conditions.

In the general plan, fig. 1, is shown a double track crossing of a steam and an electric railroad. The tower is placed in a convenient location and contains the interlocking machine *M*. The pipe line and wire lead-outs for operating the switches and signals on the steam roads require no explanation. Similar lead-outs are run to the scotch-blocks on the electric lines. These blocks are the equivalent of the derailers on the steam lines and are placed at suitable distances from the crossing, usually about 50 ft. Their construction is such as to derail a car. The signal is placed a few feet in advance of the scotch-block. To effectually control the movement of the electric cars the supply current is placed under control of the tower man, through the interlocking machine.

At a suitable distance (500 to 1,000 ft.) before reaching the crossing, the trolley wires *H* are broken by the insertion of a circuit breaker or insulating block, *C*, and at a point about 30 ft. from the crossing another circuit breaker *S* is inserted. A feed wire from this insulated section *C S* is run to the switch *F* in the tower, and this switch is connected to a lever in the interlocking machine. The switch is supplied with current by means of the wire *E*, which is supplied from the main line feeder *T*. Thus, by opening or closing the switch *F*, the current may be cut off, or supplied to the insulated trolley wire section at will. It will be noticed that the insulated section is terminated a few feet from the crossing. This is an important provision, as it insures a "live" section over the crossing at all times, making it impossible for a careless towerman to cut the motive power from a car which may happen to be on the frogs when line-clear has been given the steam road.

The details of the scotch-block are shown in fig. 2. It consists of a strong cast iron box, which is set outside of the rail and bolted securely to the ties, so that its top is flush with the street paving. In the top of the box and close to the rail is a 2-in. × 4-in. opening. A wrought iron plug, *A*, is set in this to form the stop-block. It is raised and lowered by means of the slotted crank, connected by pipe line to the tower. It will be noticed that the line of motion of this plug is oblique to the axis of the rail, and the crank having a throw of 4 in., the plug will in its derailing position project some distance from the box and over the railhead. The slotted crank has a shoulder; so that in its upper position the square end of the plug will rest upon this shoulder in line with the axis of arm and crank pin. The plug will therefore be locked in its extreme position, and the downward thrust of a car wheel will be taken upon the strong pivot pin without bringing strain upon the pipe-line connection. The construction of the block is such that it clears itself of dirt and snow, and the moving parts are effectually protected from such obstructions, drainage being provided through the open bottom of the box.

Warning of the approach of an electric car is given to the towerman by a novel and simple annunciator; it consists of a local battery bell circuit, actuated by a relay placed in the loop of the trolley wire, which is brought into the tower. As soon as a car using current passes into the insulated trolley-wire section, the magnet of the relay is energized and closes the bell circuit, giving the alarm.

This interlocking apparatus has been installed and is in satisfactory working shape at the grade crossings of the Chicago & North Shore Electric road with the Evanston Division of the Chicago, Milwaukee & St. Paul at Calvary and at Sheridan Park, Ill., and it is believed constitutes the first application of the kind in the country.

The cost of the apparatus is less than that of an interlocking plant for a plain crossing between two steam roads, as fewer levers are used and the same pipe line is used to actuate both the stop block and the signal.

TECHNICAL.

Manufacturing and Business.

The shops of the Rogers Locomotive Works, which have been closed 10 weeks, were reopened this week.

The directors of the Barney & Smith Car Company have declared a regular quarterly dividend of 2 per cent. on a capital stock of $4,500,000.

The Lewis Tool Co., of New York, has been organized with a capital of $20,000 by Mortimer G. Lewis, Edwin H. Mulford, New York City, and John R. Mulford, of Havana, N. Y.

The Clayton Air Compressor Works have removed their offices and salesrooms to the Havemeyer Building, 26 Cortlandt street, New York, retaining their former store as a warehouse.

The Knapp Railroad Car Ventilator Co. has been organized by Charles Knapp, of St. Louis, C. S. Crane, C. W. Ford and others, who manufacture the patent car ventilator of Mr. Knapp.

A company called the Duplex Improved Air-Brake Co., of East St. Louis, has been incorporated in Illinois to manufacture air-brakes under the patents of J. A. Hoff and William Pickles.

The American Railway Supply Company, of Chicago, with a capital stock of $1,000,000, has been incorporated in Illinois. The incorporators are: George W. Haines, James J. Armstrong and Charles F. Haines.

The Hale & Kilburn Manufacturing Co., of Philadelphia, has received an order for 125 cars for its patent canvas lined rattan spring seats and backs. The above orders are in addition to the contract for 55 passenger cars of the Long Island Railroad.

The iron roof over the dye house for George C. Hetzel & Co., at Chester, Pa., and the roof for the new electric light station for the Citizens' Electric Light, Heat & Power Co., at Lancaster, Pa., are to be furnished by the Berlin Iron Bridge Co., of East Berlin, Conn.

The new car wheel works of the Detroit Foundry Equipment Co., which are being erected at Harvey, Ill., are expected to be under roof by April 1. All the structural iron for the foundry building has been delivered at Harvey, and material for the other buildings is arriving rapidly.

The Chicago Railway Terminal Elevator Co. has been incorporated in New York to operate grain elevators and warehouses. The directors are: Frederick W. Whitridge, Willard Brown, Edwin T. Rice, Jr., Charles H. Ludington, Jr., James M. Drake, William H. Witner and T. Ludlow Chrystie.

The Canadian Pacific has equipped a number of its through passenger trains with the commingler steam heating system of the Consolidated Car Heating Co. The change from heating by stoves has attracted the attention of the local newspapers which appreciate the improvement and are giving the Consolidated company an abundance of free advertising.

M. L. Andrews & Co., of Cincinnati, are receiving frequent and large orders for their patent drill chuck. They have received large numbers of spindles from Philadelphia and other Eastern cities which were sent to be fitted with the new chuck. Many foreign manufacturers, especially German, have shown a high appreciation of the merits of the device. The chuck can be fitted to any old or new spindle. It is designed to prevent the drill or boring bar from dropping out of the socket.

The Craig-Reynolds Foundry Co., of Dayton, O., has recently introduced the Dayton railroad crossing gate. It is direct acting and always under the control of the operator. It is operated by wire cable, and hence is free from the difficulties due to atmospheric changes which affect so seriously some other gates. The arms can be worked in unison; they may be locked in any position by an absolute lock, perfectly controlled, and the arms of either side may be raised or lowered independent of those of the other side. These gates have been ordered by the Cleveland, Cincinnati, Chicago & St. Louis, and the Chicago & Northwestern.

The Pond Machine Tool Co., of Plainfield, N. J., for whom Manning, Maxwell & Moore, 111 Liberty street, New York, are the sole salesagents, have just been awarded the contract by the Ordnance Department of the United States Army for the manufacture of gun lathes and other machine tools required in the construction of steel, breech-loading rifle cannon of 12 in. to 16 in. calibre. The other bidders for this contract were the Niles Tool Works, Bement, Miles & Co., of Philadelphia, Pa.; Robert Poole & Son Co., of Baltimore, Md.; and the Builders' Iron Foundry, of Providence, R. I. The order consists of three lathes for boring and turning guns, one lathe for turning and finishing these guns, one machine for threading and slotting the guns and the rifling machine. This company has previously furnished to the Ordnance Department 23 large gun lathes and two rifling machines for the manufacture of breech-loading rifled cannons of 8 in. to 12 in. calibre. In the previous large contract awarded the Pond Machine Tool Co. the time for completing the work was four years, and the firm finished it near.

ly two years ahead of the time allowed, and no doubt the satisfaction given in the execution of the previous contracts, both in regard to the quality of the work and the time of delivery, favored them in the decision of the award of the present contract. The lathes are to be built from designs by the Ordnance Department, and all the detailed drawings and patterns will have to be made by the Pond Machine Tool Co. The lathes are to be erected at the army gun factory at Watervliet Arsenal, West Troy, N. Y. The firm has 18 months' time in which to complete the contract. The amount of the order is over $200,000.

Iron and Steel.

The contract for the iron work for the new iron pier to be erected at Long Branch, N. J., has been awarded to the Phœnix Iron Co., of Phœnixville, Pa.

The Oliver Iron & Steel Co. held its annual meeting at Pittsburgh, Feb. 13, and the following directors were elected: H. W. Oliver, D. B. Oliver, J. B. Oliver, John Phillips and D. A. Moore. The officers elected were: H. W. Oliver, President; John Phillips, Vice President; James B. Oliver, Treasurer; E. G. Applegate, Secretary.

The annual meeting of the Maryland Steel Co. was held in Sparrows Point, Md., on Feb. 14, and the following directors were elected: L. S. Bent, F. W. Wood, E. C. Felton, W. S. Franklin and R. K. Wood. F. W. Wood was elected President, and E. M. Smith, Secretary and Treasurer. About 500 men are working in the shops now open.

The capital stock of the Bethlehem Iron Co. is to be increased to $10,000,000, the present stock being $5,000,000. This action was decided upon at a meeting of the stockholders in South Bethlehem, Pa., on Feb. 14, when 88,478 shares of stock out of the total of 100,000 shares were represented and voted in favor of the proposition. It is understood that the present steel rail mill plant of the company is to be entirely rebuilt.

The following directors were elected at the recent annual meeting of the stockholders of the Illinois Steel Co.: Directors, H. H. Porter, Nathaniel Thayer, Francis Bartlett, Morgan Rotch, Marshall Field, A. J. Forbes-Leith, Norman Williams, J. C. Morse, W. R. Stirling, Robert Forsyth, Francis Hinton. Officers, President, J. C. Morse; Vice-Presidents, W. R. Stirling and Robert Forsyth; Secretary and Treasurer, H. A. Gay. The annual report of the Illinois Steel Co. shows a net manufacturing profit for the year of $945,508. Income from securities owned amounted to $269,186, making a total income of $1,214,694. Interest on bonds amounted to $633,127, leaving the profit for the year $581,567. The surplus for the preceding year was $536,331, making the total surplus $1,117,899. The amount written off in order to conform to present prices was $1,467,371, wiping out the entire surplus and causing a deficit Dec. 31 of $349,472. The company's principal works at South Chicago were operated only eight and one-half months of the year; the works at Joliet were operated for only six weeks; the Union works were idle during the whole year, with the exception of a short run on pig iron: the rolling mills at North works were not in operation during the last half of the year, while the Milwaukee works were unable to run full during a considerable period. Besides the curtailment of direct manufacturing profits incident to the falling off in business, a considerable diminution of income from investments in coke properties, cars, etc., was also suffered. The net addition to property account during the year amounted to $461,607.24. The company received 1,283,428 tons of raw material during the year, and shipped 422,784 tons of finished product. There was paid out in wages and salaries $3,230,885.63.

The Richmond Compound Locomotive at Chicago.

A ten-wheel compound locomotive built by the Richmond Locomotive and Machine Works for the Cleveland, Cincinnati, Chicago & St. Louis Railroad several months ago, has shown such satisfactory performance on that road for five months that the builders sent it to Chicago for a few days to exhibit it to some of the Western railroad men. The compound features of the locomotive are similar to those of the compound locomotive built by the same company for the Chesapeake & Ohio, and which was illustrated and described in the *Railroad Gazette*, April 21, 1893. The present locomotive weighs 135,000 lbs., 107,000 lbs. of which is on the drivers. The cylinders are 19 and 30 in. in diameter, and the piston stroke 24 in. The driving wheels are 56 in. in diameter. The heating surfaces are: Firebox, 172 sq. ft.; tubes, 1,756 sq. ft., a total of 1,928 sq. ft. The grate area is 31·3 sq. ft. The boiler is of the Belpaire type, 57⅞ in. in diameter. The maximum valve travel is 5½ in.

Several trial runs were made last week with the engine in freight service on the Illinois Central between Chicago and Kankakee, at which Superintendents of Motive Power of several roads were present. The most satisfactory trip was that made on the 17th, when a train of 48 cars, total weight 1,660 tons, was hauled from Kankakee to Chicago. The start was made on an ascending grade of 15 ft. to the mile for a half mile and 29 ft. for another half mile, followed by a 24-ft. grade for a distance of about two miles. The locomotive was worked single expansion on these grades, and handled the load conveniently. The steam pressure was well maintained at all times. The results of the trials were very satisfactory to those operating the locomotive and to the observers.

American Machinery and Tools in England.

A London correspondent of the *Iron Age* states that American tools, etc., to the undermentioned value were imported into England during the 11 months ending Nov. 30 last, viz.:

Agricultural implements	$547,341
Builders' hardware, saws and tools	589,005
Steam engines and other machinery	1,867,073
Total	$3,003,419

Our ability to make such heavy sales in the United Kingdom, which has long claimed the first rank in manufacturing skill and cheapness, is claimed to be due to the superior accuracy of our tools. That countervails the greater cheapness of the British product. The trade has been of slow growth but is extending on the merits of the goods offered.

Hall Signals on the Lackawanna.

Since the letting of the original contract for automatic block signals on the Delaware, Lackawanna & Western, which was announced in the *Railroad Gazette* last week, additional orders have been given, and the total amount of equipment which is to be carried out at once includes 111 block sections. This includes the line from Hoboken to Morristown, 31 miles, and from Roseville to Montclair, about five miles. The signals are to be operated by the Wilson arrangement of circuits, keeping them normally at danger, each signal to be cleared by each train as it approaches. There will be disk indicators at every switch.

Experiments in Passenger Car Ventilation.

The mechanical officers of the Pennsylvania company have been experimenting with passenger car ventilators on a train between Pittsburgh and Alliance. Eight Globe ventilators were fixed in the roof and 10 extra ventilators in the sides of the clearstory. A 7-in. pipe for admitting fresh air was placed in the end of some of the cars, being so arranged as to take in outdoor air at the top and, after passing it through a chamber containing heating pipes, delivering it near the floor. This intake has regulating valves.

Important Coupler Decision by the Arbitration Committee.

An important decision has been rendered by the Arbitration Committee of the Master Car Builders' Association with reference to vertical plane couplers, in a case between the Lake Shore & Michigan Southern and the Pennsylvania Company. The Lake Shore & Michigan Southern issued defect cards during the months of October and November, 1893, at Toledo, in interchanging cars with the Pennsylvania Company, calling for "Janney couplers cracked" and "Janney knuckles cracked." In rendering bills based upon these cards the Pennsylvania company charged Janney coupler castings at $6.25, and credited for scrap 80 cents, leaving a net charge for materials of $5.45. For Janney knuckles $3.25 was charged, with a credit of 35 cents, making a net charge for materials of $2.90. The L. S. & M. S. objects to these charges, stating that the price quoted by the McConway & Torley Co. for one Janney coupler casting, less credit for scrap casting returned, is $4, and for one Janney knuckle, less scrap forging returned, is $1. It also argues that the bills should be made in accordance with the current market prices, as per the Rules of Interchange, and that the McConway & Torley Co. has quoted these prices (when the scrap is returned) to all parties, whether regular customers or not; consequently, the current market price for one Janney coupler casting, less scrap returned, is $4, and the current market price for one Janney knuckle, less scrap returned, is $1, and asks to have the bill corrected accordingly. But the Pennsylvania company says the market price for a Janney coupler casting is $6.25, and for a Janney knuckle is $3.25; that the quotation from the McConway & Torley Co. is not to be considered as market price for new couplers and new knuckles, but that it is simply a guarantee of that company on its materials.

The decision is as follows: According to Rule 26 of the M. C. B. Code, manufactured material, not included in list, shall be at current market prices without freight charges. It is disclosed in the correspondence that broken Janney knuckles (wrought iron) and drawbars will be replaced by the manufacturer on return of the broken parts at a cost of $1 for the knuckle and $4 for the bar. As it is of such manifest advantage to a railroad company to avail itself of the credits offered by the manufacturer of the Janney coupler that it is thus uniformly made to all railroads, which safely may be stated will be accepted by the railroads, and as the Pennsylvania does not signify in the correspondence that it will not avail itself of the advantage that will accrue to it by returning the broken material to the manufacturer, therefore it is the opinion of the committee that the Lake Shore & Michigan Southern's exception is a proper one, and that the Pennsylvania's bill should be corrected so that the net charge for Janney drawbars will be $4 and for Janney knuckles $1. Mr. Potter, being interested in this case, was not a party to this decision.

The New Palisades Tunnel.

The tunnel of the New York, Susquehanna and Western Railroad, through the Palisades, is now rapidly approaching completion, the headings having met, and about June 1 it is expected that trains will be running in it. The tunnel is located at a point opposite One Hundred street, New York, in the village of Edgewater, N. J. It was built under contract, and ground was broken Aug. 1, 1892. Four shafts were sunk, the deepest of which is 196 ft., and gangs of men were put to work in both directions, and the work pushed with great energy.

The length is 5,070 ft., height 27 ft. to the crown of the arch, and width, about 33 ft., which will permit of two tracks. At present 800 ft. of the unfinished tunnel is still to be completed. The company has been fortunate in the kind of rock found, and only 150 ft. of the whole length will have to be arched with brick, the rock being solid enough the rest of the way.

The total cost of the work will be $1,700,000, which includes the building of three miles of track from the main line to the river front, all the switches and sidings of the yards, 60 acres of land, and the two docks. When the improvements contemplated at present are completed the company will have a water frontage of 1,500 ft. The coal docks are now ready for use.

Pneumatic Tube Service in Chicago.

A pneumatic tube service between the offices of the various newspapers and news associations of Chicago has just been put in operation. Twenty-nine conduits were laid under Clark street, beginning at Jackson and running north, and branching off at cross streets leading to their respective destinations. These conduits consist of seamless drawn brass tubes 2¾ in. in diameter, laid in square vitrified clay pipes, surrounded by about 10 in. of Portland cement. In this way all dampness is avoided. In sending the carriers through these tubes only the pressure of the atmosphere will be used, the necessary vacuum in the receiving end being produced by an ejector. The carrier is made of flexible leather, with an inner spiral frame to keep it in shape, and a band of felt around each end to make it comparatively air tight. It is 2¾ in. in diameter and 8 in. long. This system connects the City Press Association and the Western Union Telegraph offices, at Jackson and Clark streets, with the offices of the different newspapers, National and International News agencies and the central police station. About one minute is required for a carrier to traverse the longest line.

The London Ferris Wheel.

A sketch has been published, taken from the *Westminster Budget*, of the great wheel which, it is said, will be erected in London this year, and which was briefly noticed in the *Railroad Gazette* of Feb. 16. According to the accounts—which, by the way, are not very definite as to the financial backing of the enterprise—the wheel is to be constructed on the same general plan as the Ferris wheel, but is to be 300 ft. in diameter or about 320 ft. high. The number of carriages is to be 40. The axle will be a steel tube 50 ft. long and 7 ft. in diameter. The standards which support it will be in the form of quadrilateral towers, with two of the legs inclined toward the wheel, the style being substantially similar to that employed by Mr. Ferris. These towers will have four floors, one above another, on which will be restaurants and other rooms for the public. Hydraulic elevators are planned to provide access to these floors. It is intended to operate the wheel by two electric motors of 50 H. P. each, turning a drum moving large wire ropes, which will run in grooves on the periphery of the big wheel.

THE SCRAP HEAP.

Notes.

The falsework of the bridge on the Chicago, Milwaukee & St. Paul, near Ellis Junction, Mich., fell on Feb. 16, carrying with it 15 carpenters and laborers a distance of 25 ft. One man was killed and several injured.

A report is printed in a Chicago paper that the Pennsylvania has purchased property on Madison and Canal streets with the intention of erecting an office building on the site if certain adjoining property can be secured.

The legislature of Utah has before it a bill making train robbery punishable with death. The bill which has been presented in many states increasing the liability of employers for personal injury to employees is now under discussion in Utah.

The bill requiring railroads to stop their trains at certain stations in Oklahoma Territory was passed by the Lower House of Congress last week, after having attached to it an amendment providing that an election shall be held, so that citizens of the counties affected can determine the location of the towns at which the government will require the trains to be stopped.

The locomotive engineers on the Great Northern have accepted a reduction in wages of about 9 per cent. after remonstrating for some time. Those on the Nashville, Chattanooga & St. Louis have agreed to continue work at the reduced rates of pay that have been in force since last fall. The officers of the road have agreed to open the question of wages when earnings have sufficiently improved.

The Kansas Railroad Commissioners have made a final order in reference to the running of a passenger train on the Kansas, Nebraska & Dakota, a part of the Missouri Pacific, between Topeka & Fort Scott, and the railroad company is ordered to run a passenger train

each day between these two cities. The Board made an order of this character last fall, but the railroad asked for a rehearing, which was granted,

The Florida Central & Peninsular was recently blocked for five days in consequence of the displacement of its drawbridge over the Satilla River, Ga., by a schooner. The schooner was heavily loaded and pushed the draw span more than 15 ft. off its center and it came near falling into the river. On the night of Feb. 13 the drawdridge on the Chesapeake & Ohio Southwestern, 22 miles east of Paducah, Ky., was knocked four inches out of place by the steamer City of Paducah.

Two negroes boarded a passenger train of the Pittsburgh, Fort Wayne & Chicago at Sixteenth street, Chicago, about midnight on Feb. 14 and attempted to rob the passengers, assaulting one as they entered the car. They fired several shots, but two passengers returned the fire and these two with other passengers scared the robbers so that they got off the train and ran away.

At Roscoe, Cal., on the Southern Pacific, on the night of Feb. 15, passenger train No. 20 was derailed by the misplacement of a switch, and the engine and first two cars were ditched. The wreckers at once attacked the express car, blowing it open with dynamite, some of their number meanwhile shooting at the men who were entangled in the wreck. According to the reports the fireman and a tramp were killed by these shots; the engineer was injured. It is said that some of the robbers had been riding as passengers on the train, and that they hurried to the express car as soon as the train stopped. The rear brakeman aroused the neighborhood and sheriffs soon began searching the country. Evans and Morell, well-known desperadoes of California, were caught three days after, but it does not appear as yet that there is any evidence that they were the perpetrators of this crime.

Grand Trunk Coal Contract.

The result of the letting of the coal contracts for the Grand Trunk Railroad has been a considerable disappointment to the coal dealers of Buffalo, who, for the first time in many years, have failed to secure any portion of the contract. The company has so far given orders for about 625,000 tons of coal, the larger portion being awarded to operators in the Pittsburgh region. The mines in Pennsylvania altogether secured 450,000 tons; the Nova Scotia mines secured 80,000, delivered at Montreal, the Cumberland mines securing 35,000 tons for Portland, which has heretofore gone to the Pocahontas mines. The Cambridge mines in Ohio were awarded 70,000 tons for delivery at Detroit and Sarnia.

The Bicycle Railroad.

The indefatigable Boynton, the bicycle railroad man, is again before the public, he or his friends having built a mile and a half of single rail track at Bellport, L. I., 60 miles from New York, and put an electric car upon it. Mr. Boynton, who seems always to have an abundance of friends in the Massachusetts Legislature, had 27 members of that body at Bellport last week to see his car run. The construction of this experimental road seems to be in all respects similar to that which was built near Coney Island, two or three years ago, except that the motive power is electricity, conveyed from a power station through the overhead rail which keeps the car in an upright position. The large driving wheel, as used in the steam locomotive at Coney Island, is abandoned, wheels of ordinary size being used. The car at Bellport, like that at Coney Island, is about 4 ft. wide. The experimental road is built on the surface, the overhead rail being attached to a timber stringer supported by stout posts and brackets; but Mr. Boynton's chief aim in getting the favor of the legislators is to secure a charter for an elevated road in or near Boston.

Coal Mining in West Virginia.

The annual reports of the inspectors of mines for West Virginia show a remarkable increase in the output of coal. The percentage of increase in coal production, 25.46 per cent. over the preceding year, is the largest annual increase ever reported. The total production for the state in the year 1893 was 10,028,920 tons (gross), or an increase of 2,218,032 tons. This increase of last year was greater than the total production of 10 years ago. The increase of production from 1880 to 1893 is 520 per cent. The production of coke is less by nearly one-half than that of the year before, when it reached 1,090,909 tons. In the New River district the rate of loss was more than one-half, but this is made up in part by the increase along the line of the Norfolk & Western Railroad in the counties of Mercer, McDowell and Logan. Prospects for the present year in both coal and coke are not bright, as many of the mines are now closed.

Southern Coal and Navigation.

In 1887 a project for improving the navigation of the Black Warrior River, of Alabama, was adopted. From Mobile to Tuscaloosa, 390 miles, about 10 ft. of water can be depended on for about seven months, and possibly 4 ft. for the rest of the year. At Tuscaloosa the river falls 52 ft. in 14¾ miles, and all the improvement now under construction contemplates four stationary dams, with locks 52 × 322 ft. in place, with 6½ ft. on their miter sills. Three of these locks and dams are now approaching completion and they will open 10 miles of the river, giving access to the Warrior coalfields. It is claimed that this coal can be transported to Mobile at a cost of 35 cents a ton as compared with a cost of 80 cents on an average for Pittsburgh and West Virginia coals.

If the cost of transportion is not materially greater than the estimates it will be possible to put the Warrior coal on shipboard at from $1 to $1.25. This will make Mobile an important coal shipping port. In addition to this, when the entire improvement is completed a pool formed by the upper dam will, it is expected, draw a good deal of traffic from Birmingham and also lead to iron smelting industry on its banks.

Another project is to build a canal from the Tennessee to the Mississippi, via the Forked Deer and the Hatchie rivers, which would join the Mississippi above Memphis. Mr. J. J. Williams, the State Engineer of Tennessee, estimates the cost of such a canal at $3,000,000. No statement is made of the saving in distance to New Orleans which would be effected by it.

Ocean Telegraph Cables.

Some thousands of miles were added last year to the world's submarine cables, and this year may be even more noteworthy. The Anglo-American Cable Co. will lay a new Atlantic cable this spring, which is now making in England. The copper conducting wire of this cable will weigh 650 lbs. per knot, while hitherto no cable has had a conductor weighing so much as 500 lbs. per knot. The Atlantic cables have conductors weighing 400 lbs. or less per knot. Many short cables have cores weighing as little as 107 lbs. Cables 1,900 miles long on the east coast of Africa have cores weighing 250 lbs. to the knot. The heaviest core is that of the French cable from St. Pierre, Miquelon, to Brest. It is 2,212 miles long and weighs 485 lbs. per knot. The estimated cost for making and laying long cables is about $1,200 per knot. The cost of the proposed Pacific cable will be somewhat greater, because it cannot be manufactured in the vicinity The total length, exclusive of 740 knots already laid in Australasian waters, will be about 5,900 knots, making the total cost about $6,200,000 for cable and laying alone.

The Metric System in Foreign Trade.

In the last report of the British Foreign Office on the commerce of Bulgaria, it is stated that English catalogues are sent out in French or some other foreign language, but that the English standards of weights and measures are retained. The metric system is the one now employed throughout Bulgaria, and it is useless for English manufacturers to expect that their potential foreign customers will give themselves the trouble of learning our avoirdopois and dimension tables. Complaints are reported from Peru that shipping specifications have to be made out in metric weights and measures, and if there are any errors the customers are liable to a fine. This means that the specifications have to be made twice over, first in English and then in metric weights and measures. It is therefore urged that the metric system should be adopted officially in England. This would doubtless lead to its adoption by shipowners and carriers, and take us one more step in the direction of an international system.

The same inconvenience must be suffered by Americans doing business with the countries of South America, and the same reasons hold for its adoption by business men in the United States.

Railroads in Central Asia.

The *Colliery Guardian* learns, through a correspondent, that a project for an extensive network of rail roads in Central Asia is in contemplation. The Russian government sees that the resources of the trans Caspian region can only be developed by the aid of railroads, which will also insure the peace and future prosperity of that great Asia which has cradled so many branches of our race. It is proposed to ask the different khanates to contribute toward the very heavy expense involved in the construction of the roads; an expense that will be speedily returned to them by the development which will follow the decreased cost of transportation. The Russian government has also made provision in its budget for 1894 for the expenditure of 65,293,000 roubles, say $40,000,000, for the construction of railroads and harbors; 1,385,000 roubles of this sum are to be applied to the construction of the trans-Siberian railroad.

It is fortunate that the Russians are undertaking the construction of railroads in so large an area of Asia. They, next to ourselves, seem to have the greatest genius for rapid and economical railroad building. This combined with the efficient working of not strictly first class appliances in the way of roadbeds, etc., is the growing friction in the development of a country that has been impoverished or held back by lack of transportation facilities. Their success in the moral regeneration as well as the industrial development of the country tributary to the Trans-Caspian Railroad has been phenomenal, even though English visitors pointed out many shortcomings in the construction and equipment of the road.

Coal at Dover.

Prof. Boyd Dawkins said at a late meeting of the Manchester Geological Society that the experimental boring at Dover had now reached a depth of 2,181 ft. Between that depth and 1,113 ft. 12 seams of coal, great and small, had been pierced. The aggregate workable depth of the seams was 18 ft. The Professor concludes that the horizon of the southeastern coal field is that of the valuable upper measures of Somersetshire and of the important middle coal measures of Belgium and Northern France. This boring seems to assure an industrial future to the southeastern part of England that has hitherto been lacking for want of cheap fuel. In conclusion the learned Professor said:

"It now remained to develop the coalfield to the advantage of the industries of the district; and if the artists objected, they might perhaps be consoled with the thought that after all the effect for them would only be to turn the cliffs of Dover into studies in black and white."

Disastrous Train Wreck in Russia.

A press dispatch of Feb. 15 reports a train wreck near Jelan, Russia, on the Samara-Zlatoosk Railroad, 12 cars being destroyed and 13 persons killed. On Jan. 25 a passenger train came into collision with a freight train near Samara, Russia, and 15 persons were killed, five cars of oil taking fire and the wreck being burned.

Rail Production in France.

The following statement by the Comité des Forges de France shows the consumption of rails by French railroads for a series of years:

	Metric tons.		Metric tons.
1869	183,628	1887	108,898
1875	217,546	1888	93,868
1880	208,553	1889	58,046
1883	341,334	1890	66,814
1884	284,031	1891	112,857
1885	249,416	1892	163,840
1886	170,595	1893	129,338

The French requirements of 1893 would keep a modern American mill fairly busy for six months.—*Iron Age.*

A Passenger Cableway.

Mr. Gilmore Brown is preparing a profile plan of the shores of the Ohio River at Wheeling, W. Va., in order to receive bids for the construction of a cable line from Wheeling proper to Wheeling Island, across the main channel of the Ohio River, a distance of about 3,000 ft. The cable line is to be for the tranportation of passengers exclusively, and is to be operated in competition with the two bridges already in existence. In response to inquiries made of the Lidgerwood Manufacturing Co., of New York, Mr. Brown and his associates have received assurances that the plan is entirely practicable, and that two cars, carrying 50 people each, and making the trip across at the rate of 1,000 ft. per minute, can be carried without swinging or danger. There is at present no such cable line in the world for the conveyance of passengers, but a number of freight cableways are used for convenience by passengers.

LOCOMOTIVE BUILDING.

The order of Coxe Brothers & Co., of 143 Liberty street, New York, for the Delaware, Susquehanna & Schuylkill engines, has been awarded to the Baldwin Locomotive Works. The order is for 10 heavy freight engines.

CAR BUILDING.

The Central Vermont is building 10 freight cars at its St. Albans shops.

The Gulf, Colorado & Santa Fe shops at Gaveston have recently built a passenger train for the road consisting of a passenger car, chair car and baggage car.

The Mount Vernon Car Mfg. Co., of Mount Vernon, Ill., is building a number of ventilated fruit cars of 60,000 lbs. capacity, with Westinghouse brakes, for the Florida Central & Peninsular.

The New York, Susquehanna & Western has let the contract for 300 coal cars, 50,000-lb. capacity, 200 to the Bloomsburg Car Co., of Bloomsburg, Pa., and 100 to Murray, Dougal & Co., of Milton, Pa. The cars are to be delivered by June.

BRIDGE BUILDING.

Augusta, Ga.—The Port Royal & Augusta proposes to build a new iron bridge about 808 ft. long with two fixed spans and one draw span across the Savannah River, about three miles below Augusta. The cost will be about $25,000. B. W. Howe, Jr., of Savannah, will be the Bringe Engineer.

Baltimore, Md.—A bill has been introduced into the Maryland Legislature giving the County Commissioners authority to build a bridge over the Patapsco River.

Boston.—The City Council has passed an ordinance appropriating $750,000 for the construction of a new drawbridge connecting Boston and Charleston, to replace the present Charles River bridge. The construction of this bridge has been under discussion for a long time. Mayor Matthews, of Boston, recently recommended to the City Council the appropriation of the sum mentioned above, stating that the present Charles River bridge would soon be in an unsafe condition, and as there was but one other bridge connecting with Charleston and the city proper a new bridge was necessary to accommodate the large traffic. The sum appropriated is not intended to cover the cost of constructing the approaches. The plan for the Boston approach cannot be settled upon until the question of building the subway for the proposed underground railroad is decided, one way or the other.

Cambridge, Mass.—A resolution has been adopted by the City Council providing that a joint special committee be appointed to consider the rebuilding of the Brookline and Boylston bridges, and also the construction of a bridge across the Charles River at the foot of Magazine street.

Chicago.—The Schultz Bridge & Iron Co. has been awarded the contract for the erection of a patent lift bridge to be erected in Chicago. The structure will call for about 500 tons of iron.

Columbus, O.—Bids for the construction of the Front street bridge (opened Feb. 18) were as follows: New Jersey Steel Works, $62,000; Sawyer & Arthur, Columbus, O., $62,450; Pittsburgh Bridge Co., $59,000; Groton Bridge & Manufacturing Co., Groton, N. Y., $49,900; Toledo Bridge Co., $59,000; Milwaukee Bridge & Iron Works, $60,553; King Bridge Co., Cleveland, O., $56,054; Massillon Bridge Co., $66,500; Edgemore Bridge Works, Edgemore, Del., $51,700 and $56,000; Etna Construction Co., Columbus, O., $48,680; Wrought Iron Bridge Co., Canton, O., $69,500; Variety Iron Works, Cleveland, O., $58,375; Mt. Vernon Bridge Co., $63,508; Youngstown Bridge Co., $63,315; Phœnix Bridge Co., Phœnixville, Pa., $50,853; Pennsylvania Steel Co., Steelton, Pa., $56,900; Detroit Bridge and Iron Works, $51,760 and $52,984; Columbus Bridge Co., $63,990; Penn Bridge Co., Beaver Falls, Pa., $56,500, $63,700, $64,000 and $66,350. The bridge is to span the tracks of the Pittsburgh, Cincinnati, Chicago & St. Louis, and the Cleveland, Cincinnati, Chicago & St. Louis. No award has yet been made.

The Clifton avenue bridge over Alum Creek, for which proposals are to be received up to March 23, is to be a two-span riveted plate girder, with 28 ft. roadway, two 6-ft. sidewalks and steel joists. The bridge over the same stream at the Sunbury Pike, which is to be bid on March 26, is to be a two span plate girder, 75 ft. long, with 28 ft. roadway and steel joists. The legislature authorizes the expenditure of $10,000 in each instance.

Fort Wayne, Ind.—The County Commissioners are considering the construction of a bridge over the Maumee River in the eastern part of the city.

Knoxville, Tenn.—Representative Houk, of Tennessee, has introduced in the House of Representatives a bill authorizing the construction of a bridge across the Tennessee River at this place. The proposed bridge is to replace the present wooden bridge at this point.

Milton, Pa.—Plans have been decided upon for a joint county bridge across the Susquehanna River between Milton and West Milton. The contract will be let March 16. Bids for both iron and wooden structures will be received.

Milwaukee, Wis.—The Wisconsin Bridge Co., of Milwaukee, has contracted for two steel bridges for the main line of the Wisconsin Central road, one at Chippewa Falls and the other at Gill's Landing at the crossing of the Wolf River.

C. L. Strobel, of Chicago, has been awarded the contract for building the Sixteenth street viaduct in this city on his bid of $182,000.

Onondaga, Ont.—S. J. McKelvie, Clerk, is receiving tenders up to Feb. 26 for building an iron or steel bridge over Fairchild's Creek, at Howell's Mill, in the township of Onondaga. Plans and specifications at the office of John Fair, Township Engineer, Brantford, Ont.

Tacoma, Wash.—The bids for the construction of the Eleventh street bridge in Tacoma have all been rejected by the Board of Public Works. The matter of building this Eleventh street bridge has been under discussion at Tacoma for over a year, and proposals were opened this month from about 10 bridge building companies who put in bids varying from $90,000 to over $108,00

the lowest bid being that of H. Krusi, representing the San Francisco Bridge Co. The cause for rejecting the bids is a new development in the financial complications which have so long delayed the construction of the bridge after its authorization. The city proposes to issue its bonds to pay for the bridgework, but was unable to effect a sale of the bonds at par, as provided in the city charter. In advertising for bids it was stipulated that the proposals were to include bids for the bonds at par. The Sinking Fund Commissioners have now found some objection to this arrangement, and the Board of Public Works has therefore been compelled to reject the bids. There is some objection to readvertising until the bonds are sold outright and the bridge contract can be let on a cash basis.

Tuskaloosa County, Ala.—The Commissioners of Tuskaloosa County have let contracts for the building of steel bridges across big Sandy Creek on the Greensboro road and across Davis' Creek on the Thompson's Mill road. The bridges will cost about $5,000 each. J. H. Whitner, of Knoxville, Tenn., has been awarded the contract.

MEETINGS AND ANNOUNCEMENTS.

Dividends:

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago, Burlington & Quincy, quarterly, 1¼ per cent., payable March 15.

Fort Wayne & Jackson, semi-annual, 2¾ per cent.

Philadelphia & Erie, 2 per cent. on the common stock, payable March 1.

Piedmont & Cumberland, $2.50 per share.

West Virginia Central & Pittsburgh, annual, 1 per cent.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Atlanta & Charlotte Air Line, annual, New York City, March 14.

Florida Central & Peninsular, annual, Jacksonville, Fla., March 1.

Grand River Valley, Jackson, Mich., April 25.

Gulf, Colorado & Santa Fe, annual, Galveston, Tex., March 6.

Missouri Pacific, annual. St. Louis, Mo., March 13.

New York, Lake Erie & Western, special, New York City, March 6.

New York & New England, annual, Boston, Mass., March 13.

Norfolk & Southern, annual, Norfolk, Va., March 1.

Pennsylvania, annual, Philadelphia, Pa., March 13.

St. Louis, Iron Mountain & Southern, annual, St. Louis, Mo., March 13.

Sterling Iron & Railway Co., annual, New York City, March 6.

Wabash, annual, St. Louis, Mo., March 13.

Western Terminal Co., special, Pittsburgh, Pa., Mar. 20.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Master Car Builders' Association* will hold its annual convention at Saratoga, N. Y., June 12. The hotel headquarters will be at Congress Hall, H. S. Clements, Manager.

The *Master Mechanics' Association* will hold its annual convention at Saratoga, N. Y., June 18.

The *Freight Claim Association* will hold its annual meeting in Louisville, Ky., March 14.

The *National Association of Local Freight Agents* will hold its annual convention at Pittsburgh, Pa., June 12, 13, 14. The headquarters will be at the Monongahela House.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Wednesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the fourth Wednesday of January, March, April, September and October. The next meeting will be on Wednesday, March 28.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November. The next meeting will be on Thursday, April 19, at 10 a. m.

The *Western Railway Club* meets in the rooms of the Central Traffic Association, Monadnock Building, Chicago, on the third Tuesday in each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *Northwest Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, except during June, July and August, at 8 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Tacoma Society of Civil Engineers and Architects* meets in its rooms, 201 Washington Building, Tacoma, Wash., on the third Friday in each month.

The *Association of Engineers of Virginia* holds informal meetings the third Wednesday of each month, from September to May, inclusive, at 719 Terry Building, Roanoke, at 8 p. m.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, 36 Bromfield street, Boston, on the third Wednesday in each month, at 7:30 p. m.

The *Western Society of Engineers* meets at 78 La Salle street, Chicago, on the first Wednesday in each month, at 8 p. m.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas Place, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Engineers' Society of Western Pennsylvania* meets at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month at 8 p. m.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo, on the second Monday in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. The next meeting will be Friday, March 16.

Technical Society of the Pacific Coast.

The members of the Technical Society of the Pacific Coast have elected the following officers for 1894: President, C. E. Grunsky; Vice-President, Geo. W. Dickie; Secretary, Otto von Geldern; Treasurer, W. C. Ralston.

Central Association of Railway Officials.

This Association held its annual meeting at Columbus, O., last week, with representatives present from Cincinnati, Indianapolis, Louisville, Newark, Columbus and other cities. The principal topic discussed was "Mileage rates for interchanged freight cars." President Ralph Peters, of Cincinnati, Superintendent of the Cincinnati Division of the Pan Handle, presided. The officers elected for the ensuing year are: President, J. M. Graham, Newark (B. & O.); Vice-Presidents, Brent Arnold, of Cincinnati (Louisville & Nashville), and M. K. Elliott, Indianapolis (Vandalia); Secretary and Treasurer, O. G. Fetter, Cincinnati, Superintendent Cincinnati Car Service Association.

PERSONAL.

—Mr. R. J. M. Danley, Superintendent of Telegraph of the Columbus, Shawnee & Hocking, at Columbus, O., has resigned in order to promote several electrical inventions, in which he is interested.

—Mr. W. K. Morly, formerly Division Superintendent of the Chicago & Alton, has been appointed General Superintendent of the Kansas City, Pittsburgh & Gulf, with headquarters at Kansas City, Mo.

—Mr. Herschel Roberts, who was Chief Engineer of the Adirondack & St. Lawrence Railroad during its construction, is now Division Engineer of the New York State Canals, with headquarters at Albany, N. Y.

—Mr. C. M. Williams, for years Secretary and Treasurer of the Union Depot Co. at Columbus, O., has resigned on account of private business, and J. P. Howley, of Indianapolis, Traveling Auditor of the Pennsylvania Lines west of Pittsburgh, has been temporarily appointed to the place.

—Mr. B. S. Sutton, Division Superintendent of the Cleveland, Cincinnati, Chicago & St. Louis, has resigned. He has been Division Superintendent of the company since 1889, and has had charge of the White Water and Cairo divisions. He was formerly with the Chesapeake & Ohio as General Agent at Ashland, Ky.

—Mr. W. C. Watson, General Passenger and Ticket Agent of the Atlantic System of the Southern Pacific, has resigned that office, taking effect on March 1. Mr. Watson has been with the Southern Pacific since 1877. He was for a time Chief Clerk for T. W. Pierce, General Passenger Agent, and succeeded that officer in 1886.

—Mr. W. L. O'Brien, formerly General Passenger Agent of the Pittsburgh, Cincinnati, Chicago & St. Louis, died suddenly at Cincinnati, O., last week. He was 60 years old. Mr. O'Brien was succeeded as General Passenger Agent of the "Panhandle" lines in 1880 by Mr. E. A. Ford, and at that time was appointed General Southern Agent of the Pennsylvania lines, with office at Cincinnati. He retired from this position over a year ago.

—Mr. Samuel Porcher, formerly Assistant Superintendent of Motive Power of the Pennsylvania, at Jersey City, has been promoted to be Assistant Purchasing Agent of the company, to succeed Mr. A. W. Sumner, who was made Purchasing Agent on the retirement of Enoch Lewis a few months ago. The appointment takes effect March 1. Mr. Porcher entered the Pennsylvania service 12 years ago, beginning work at the Altoona shops. He was appointed Assistant Superintendent of Motive Power at Jersey City in 1888.

—Mr. T. C. McNeely, Division Superintendent of the Central of Georgia, has resigned, to take effect on March 1. Mr. McNeely became Superintendent of the Main Stem Division of the Central of Georgia in June, 1892. The appointment was unusual, for Mr. McNeely was then only 25 years old, and he was put in charge of the most important division on the Central of Georgia, over 300 miles. Mr. McNeely was on various divisions of the Richmond & Danville from 1880 to 1891. The latter year he became clerk in the General Superintendent's office of the Central of Georgia, in charge of the Transportation Department, until his appointment as Division Superintendent.

—Mr. James G. Hubbard, Master Mechanic of the New York, Lake Erie & Western, in charge of the shops at East Buffalo, died at Buffalo, N. Y., on Feb. 13. Mr. Hubbard learned the machinist trade in the Schenectady Locomotive Works, and became connected with the Erie road in 1861. He served as Master Mechanic of the Buffalo & Southwestern for six years until that road was leased to the Erie in 1880, when he became Foreman of Car Repairs of the East Buffalo shops, retaining that position until October, 1892, when he was promoted to be Master Mechanic. Mr. Hubbard was an unusually skillful mechanic, and in the positions of trust to which he was appointed developed sound judgment and considerable force of character.

—Mr. H. W. B. Glover has been appointed General Freight Agent of the Seaboard Air Line, and as such will have charge of the freight traffic on this system. The office of Traffic Manager held by the late Mr. O. V. Smith will be abolished. Mr. Glover has been acting as General Freight Agent of this road since last November, when Mr. Smith retired from active charge of the department on account of failing health. Before this he had been Division Freight and Passenger Agent of the road at Atlanta, having held that office since 1889. Mr. T. J. Anderson, whose title has heretofore been Passenger Agent, will hereafter be General Passenger Agent of the road. Mr. W. L. O'Dwyer becomes Division Freight and Passenger Agent at Atlanta, Ga.

ELECTIONS AND APPOINTMENTS.

Brady's Bend & Butler.—The following are the directors of this company recently incorporated in Pennsylvania: William J. Hammond, R. R. Hammond, Pittsburgh, Pa.; Jerome D. Griffith, New York, and Charles O. Billings, Boston, Mass., the latter being President.

Chattanooga, Rome & Columbus.—Receiver Eugene R. Jones has announced the following appointments: C. D. Wilburn to be Superintendent and Traffic Manager; Milo S. Freeman to be Auditor; and William Love to be Master Mechanic, all with headquarters at Rome, Ga.

Delaware, Lackawanna & Western.—The expected changes in the board of directors were made at the election held in New York City, Feb. 20. H. McK. Twombly, Frank Work, and H. C. Fahnestock were elected, succeeding A. H. McClintock, W. H. Appleton and R. F. Ballantine. Messrs. Twombly and Work are additional representatives of the Vanderbilt interests. The board is now as follows: John I. Blair, Samuel Sloan, George Bliss, Percy R. Pyne, William Waldorf Astor, William Rockefeller, Eugene Higgins, Henry A. C. Taylor, J. Rogers Maxwell, George F. Baker, James Stillman and Alexander T. Van Nest, H. McK. Twombly, Frank Work and H. C. Fahnestock. Samuel Sloan was re-elected President, having held that office since 1869. Frederick F. Chambers, Secretary, and Frederick H. Gibbens, Treasurer.

Duluth, Missabe & Northern.—S. R. Payne, Secretary of the company, has been appointed Purchasing Agent, with headquarters at Duluth, Minn.

Eastern, Nebraska & Gulf.—The following are the officers of this company recently incorporated in Iowa: President, A. W. Swanitz, New York City; Vice-President, F. A. Seaman; Secretary, J. B. Keepe, both of Sioux City, Ia; Treasurer, C. J. O'Connor, Horner, Neb.; General Manager, W. C. McNamara, Sioux City; Chief Engineer, F. W. Kimball, Austin, Minn.

Holly River.—The following are the officers of this company: President, C. R. Palmer, of Burlington, Vt.; General Manager, John C. Arbogast; Treasurer and General Passenger and Freight Agent, J. E. Craddock, both of Palmer, W. Va. The New York representatives of the company are W. E. Marsh & Co., No. 82 Wall street.

Lake Street Elevated, Chicago.—M. J. Comerford, formerly Roadmaster of the Kings County Elevated Road of Brooklyn, N. Y., has been appointed to a similar position on this road.

Lake Superior & Gulf.—The first annual meeting of this road was held in Des Moines, Ia., Feb. 16, and the following directors elected: E. R. Bristol, Memphis, Tenn.; L. M. Martin, J. L. Howard, Des Moines; J. M. Miller, Springfield, Mo.; M. B. Austin, St. Louis, and J. A. Hinsey, Chicago. The officers elected were: President, E. R. Bristol, Vice-President, L. M. Martin; Secretary, J. M. Miller, Assistant Secretary, J. L. Howard, Treasurer, J. A. Hinsey.

Market Street, Richmond & Frankfort.—The directors of the company are: G. Frederick Jordan, G. Frederick Keene, Theodore Cramp, of Philadelphia; William H. McManus, of Chester, Pa., and John Dougherty, of Englewood, N. J. Theodore Cramp is president.

New York, Chicago & St. Louis.—The headquarters of W. L. Blair, Superintendent of the Eastern Division, have been removed from Cleveland to Conneaut, O.

New York, Lake Erie & Western.—The following appointments have been made: I. Bond, of Hornellsville, N. Y., to be Master Mechanic of the Susquehanna shops, to succeed Washington Lavery, promoted, C. P. Weiss, Master Mechanic at Rochester to be Master Mechanic at Hornellsville, and F. N. Hibbits, Mechanical Engineer at Susquehanna, to be Master Mechanic at Rochester.

Philadelphia & Erie.—At a meeting of the Board of Directors held in Philadelphia, Pa., Feb. 16, N. Parker Shortridge was elected President and J. S. Van Zandt was elected Secretary and Treasurer. W. Hassell Wilson, formerly President of the road, resigned from the Board of Directors, and John H. Catherwood was elected to succeed him.

Richmond & Danville.—Edward J. Graham has been appointed Assistant Passenger and Ticket Agent. He was formerly with the Louisville & Nashville.

Rio Grande & Western.—Q. Lamplaugh, formerly Master Mechanic of the Denver & Rio Grande at Denver, has been appointed Master Mechanic of this road.

Savannah, Americus & Montgomery.—C. W. Chears, formerly Assistant General Freight Agent of the Kansas City, Fort Scott & Memphis, has been appointed General Freight and Passenger Agent to succeed C. B. Wilburn, resigned to become Traffic Manager of the Chattanooga, Rome & Columbus.

St. Louis, Keokuk & Northwestern.—F. H. Bleeker has been appointed Division Superintendent, his jurisdiction extending over the new road from North St. Louis to Bellefontaine.

Texas Central.—The annual meeting of the stockholders was held in Waco, Tex., Feb. 14. The resignation of Mr. Cornelius B. Gold as Chairman of the Board of Directors and as a Director was accepted, and the office of Chairman abolished. Walton Ferguson, of Stamford, Conn., was elected Director to fill the vacancy caused by the resignation of Mr. Gold. The following officers were elected: Henry K. McHarg, President; Charles Hamilton, Vice-President and General Manager, and Richard Oliver, Waco, Secretary and Treasurer.

Texas Midland.—J. B. Tartt has been appointed Auditor, to succeed G. S. Reid, appointed General Freight Agent, with office at Terrell, Tex.

Union Pacific.—J. H. Payne, of Cripple Creek, has been appointed Assistant Engineer, to succeed H. W. Cowan, resigned, to become Chief Engineer of the Union Pacific, Denver & Gulf. A. H. King has been appointed Supervisor of Bridges and Buildings of the Wyoming division, with headquarters at Cheyenne, Wyo. Mr. King has been acting in that capacity for some time.

Union Pacific, Denver & Gulf.—B. L. Olds has been appointed Purchasing Agent, with office at Denver, Col.

Valley (Penn.).—The following are the directors of this road, recently chartered in Pennsylvania: Elijah R. Schoonmaker, of Binghamton, N. Y., and Edward W. Bell, Frank Williams and Samuel T. Swartz, of Bradford, Pa. Charles H. Weed, of Binghamton, N. Y., is President.

Western New York & Pennsylvania.—Peter Fowler, formerly General Foreman of the Lake Shore & Michigan Southern machine shops at Buffalo, N. Y., has been appointed Master Mechanic of the Pittsburgh Division of this road with headquarters at Oil City, Pa., to succeed C. H. Newman, resigned.

West Virginia Central & Pittsburg.—Alexander Shaw, of Baltimore, has resigned as a director, and F. S. Lanstreet, of Davis, W. Va., has been elected to succeed him.

Wheeling & Lake Line.—The directors elected at the annual meeting held in Toledo, O., Feb. 13, were: A. G. Blair, George W. Davis, George E. Pomeroy, S. C. Reynolds, of Toledo; John Greenough, Frank R. Lawrence, E. K. Sibley, Arthur W. Soper, of New York; Earl W. Oglevay, of Cleveland. The officers elected were: President, Frank R. Lawrence; Vice-President, John Greenough; General Manager, A. G. Blair; Secretary and Treasurer, James M. Ham; Assistant Secretary, Downer Adams.

Wilmington, Newbern & Norfolk.—The following directors were elected at the annual meeting held in Wilmington, N. C., Feb. 7: Thomas A. McIntyre, William A. Nash, A. S. Kirkman, Samuel Taylor, Jr., and Joseph A. Knox, of New York; H. A. Whiting and Charles M. Whitlock, of Wilmington; Dr. R. W. Ward, of Amans Store, N. C., and C. E. Troy, of Newbern. The officers elected were: President, Thomas A. McIntyre; Vice-President and General Manager, H. A. Whiting; Treasurer, William A. Nash; Secretary, Charles M. Whitlock; Traffic Manager, J. W. Martenis.

Wyoming & Utah.—Isaac Van Horn, formerly General Manager, has resigned, and all communications should be addressed to C. S. Rogers, Chief Engineer, 625 Chestnut street, Philadelphia, Pa. The Boston office of the company remains at 89 State street.

RAILROAD CONSTRUCTION, Incorporations, Surveys, Etc.

Baltimore & Cumberland.—Thomas K. Recket and M. M. Frick, contractors, of Pottsville, Pa.; F. H. Clement, of New York; F. H. Lane, of Lane Brothers, of Morgantown, W. Va., and several other well known railroad builders have visited the office of Chief Engineer Chauncey Ives, at Hancock, Md., within the past few weeks, arranging to place bids for building the road, which is to extend from Cumberland east to Hagerstown, 60 miles. Nothing definite is settled in regard to letting the contracts. The officers expect to have the work started this spring, but have as yet fixed no date.

Brady's Bend & Butler.—This road was recently chartered at Harrisburg, Pa. The route is from a point on the north side of the Allegheny River, opposite East Brady in Armstrong County, southwest through Perry, Fairview, Concord, Oakland and Centre in Butler County, to a point on the Pittsburgh, Shenango & Lake Erie, about five miles north of the town of Butler. The length of the road will be 12 miles. Charles O. Billings, Boston, Mass., is President.

Chicago, Paducah & Memphis.—Engineers are reported to be running lines for this proposed road south of Altamont toward the Ohio River, near Metropolis, a town opposite Paducah, Ky. The surveys are in charge of T. P. Reed, of St. Elmo, who has pecently been appointed Chief Engineer. The road will be built by Johnston Brothers & Faught, of St. Elmo, who are largely interested in the project. W. L. Huse, of St. Louis, is President.

Cleveland, Lorain & Wheeling.—The bids for the grading, masonry and trestle work on the new line into Cleveland, O., will be received by the Chief Engineer, W. C. Jewitt, of Cleveland, O., until March 1. The work will include about 28 miles of new road from Mallett Creek, O., near Medina to the village of Brooklyn, near Cleveland.

Dry Fork.—This road, which is to connect with the West Virginia Central & Pittsburgh Railroad at Hendricks, has 25 miles of road way graded, and will begin laying rails along the valley of Dry Fork of Cheat River. The work is progressing rapidly, and the report made by the officers to the meeting of the directors of the West Virginia Central & Pittsburgh, at their meeting in Baltimore last week, shows that the line will be completed in three months.

Duluth & Winnipeg.—The United States Senate Committee has made a favorable report on the bill to authorize this company to build its line across the White Earth and Red Lake reservations in Northern Minnesota. This bill is of some importance because if it passes Congress there is a fair chance of the railroad being extended to the Manitoba boundary line. The recent purchase of the road by the Duluth, South Shore & Atlantic gives the control to the Canadian Pacific, which desires the extension built to connect with its lines.

Eastern Nebraska & Gulf.—F. W. Kimball, of Austin, Minn., who is Chief Engineer of this recently chartered company, is arranging to have an engineers' party start out from Sioux City before March 1. The field party will probably be in charge of L. F. Wakefield, of Sioux City, and it is contemplated to finish the preliminary survey for the first 50 miles south of Sioux City through Nebraska during the spring. A. W. Swanitz, of New York City, is President of the new company, and W. C. McNamara, of Sioux City, is General Manager.

Gladeville.—President E. M. Fulton, of Wise Court House, Va., announces that the grading on this road will be completed during the next few weeks. President Fulton is now ready to make contracts for the rails and track material, and is also ready to receive bids for equipment. The road is a short line connecting with the Norfolk & Western Railroad, and extending from Gladeville to near Wise Court House.

Grand Island & Northern Wyoming.—The Washington dispatches announce that the right of way for the extension of the line beyond Sheridan, Wyo., has been approved by the Interior Department of the United States. This line is controlled by the Burlington, and is the charter which has been used in the extension of that line through Northern Wyoming. The present terminus is a few miles beyond Sheridan near the Montana State line. The surveys have been made beyond this town to Billings, Mont., over 100 miles, but the newspaper report does not indicate whether all of this route or only a portion has been approved by the government.

Gulf, Beaumont & Kansas City.—The narrow gage road of the Beaumont Lumber Co., known as the Beaumont & Northeastern, extending from Fords Bluff, on the Neches River, northeasterly to the town of Buna, a distance of about 11 miles, has been purchased by this company. The gage will be widened at once. The company is now extending its main line from Cooks Bluff in Hardin County to Fords Bluff in Jasper County, a distance of 7½ miles. This work includes a drawbridge across the Neches River.

Gulf & Interstate.—The newspaper reports that the projectors of this road, which is the corporate title of the Populist scheme for a "north and south" railroad, have arranged for a party of engineers to go over part of the line, starting from near Galveston and working north. A. C. Titus, of Ottawa, Kan., will be in charge of the party. It is explained that this show of activity is made because it has been agreed to build 20 miles of railroad from Bolivar Point opposite Galveston, where a land company has given some "hundreds of acres of land for a Gulf terminal."

Holly River.—The railroad being built by the Holly River Lumber Co., of Palmer, W. Va., is now completed for about 12 miles from Palmer, a station on the West Virginia & Pittsburgh. The road extends northeasterly from that station up Holly River to Marple, Laurel and McLean. Most of the work on the line was completed during 1893, and it is not proposed to do much in the way of extension or other construction work this year. The principal traffic will be in hauling logs and lumber. The road is equipped with two locomotives and 30 logging cars. It is standard gage, built with light grades and easy curves. John C. Arbogast, of Palmer, W. Va., is General Manager.

Lake Superior, Southwestern & Gulf.—The projectors met at Des Moines, Ia., last week and elected Directors and officers for the company. It was reported then that L. S. Steadman, Chief Engineer, was engaged in a survey of the projected line. It was also said that the contract has been let to Rosenfield Brothers, of Omaha, Neb., for work between Little Rock and Aurora, Mo. E. R. Bristol, of Minneapolis, is President, and L. M. Martin, of Des Moines, Ia., is General Manager.

Louisiana, Arkansas & Missouri.—H. A. Fisher, of St. Louis, Vice-President and General Manager of this railroad, is arranging to resume the construction work on the railroad and expects to complete about 20 miles of tracklaying this spring. This work will be on the portion of the road already graded south of Mason Lake, Ark. The road is now in operation between Trippe and Mason Lake, 15 miles. Bryan City, La., 105 miles south of Mason Lake, will be the objective point of the present year's activity.

Market Street, Richmond & Frankfort Elevated Electric.—This long title has been adopted by a company which has been peculiarly fortunate in the treatment it has received from the City Council at Philadelphia. The company proposes to build an elevated railroad to reach the northeastern part of Philadelphia, and announces that it will use electric locomotives. The ordinance introduced in the City Council giving it the right to build through the city streets was passed with practically no opposition. There are a few restrictive clauses in the charter, the only provisions being that the fare shall not exceed five cents during the day, that work shall begin within six months and that a bond for $50,000 be filed with the city authorities. The route proposed in the ordinance is eight miles long. The road is to start from Ninth and Market streets and will extend along Chester, Garden, Noble and other streets to Frankfort and thence to Cheltenham. Theodore Cramp is President of the new company; and G. Frederick Keene is General Manager.

Middle Georgia & Atlantic.—The extension of this line into Covington, Ga., has been completed finally and trains are now running into that town from Milledgeville, the eastern terminus of the road. The line now completed is 70 miles long through a fertile and well cultivated part of the state. The portion of road now in operation is but a small part of the line projected. The ambition of the directors has been to complete a through line between Atlanta and Savannah, and several years ago a company was formed to undertake this work which secured a good deal of right of way besides a large tract of land on the coast near Savannah for a terminal. That plan had to be abandoned for the time, although it has not been given up.

Midland Terminal.—The contract has been let for the completion of the line from Midland south to Cripple Creek, Col. The line will be standard gage instead of narrow gage, as at first contemplated. The maximum curvature will be 16 deg., and the maximum grade three per cent. for five miles. There will be a tunnel 475 ft. long.

New Roads.—B. T. Spencer, of Blaine, Wash., is the incorporator of a railroad to be built from Blaine via Linden to a connection with the Seattle, Lake Shore & Eastern at Nooksack. Some right of way has been obtained, and the projectors have also secured a subsidy from the town of Blaine, and claim that they are prepared to go ahead with the construction work without much delay.

The project of building a road from Philadelphia to West Chester via Media, abandoned in 1890, has been revived and New York capitalists have been offered the right of way and are considering the matter favorably. Property holders along the line, it is stated, will subscribe for a large amount of the stock.

H. A. Sturgis, of Topeka, Kan., has completed the survey for a proposed railroad from Highland, on the Burlington & Missouri River, in Doniphan County, to Ryans, on the St. Joseph & Grand Island. The proposed road will be seven miles long.

Point Pleasant, Buckhannon & Tygarts Valley.—Messrs. J. W. Heavener and James Burnsides, of Buckhannon, W. Va., representing the stockholders of this company, met with President Henry G. Davis and the directors of the West Virginia Central & Pittsburgh Railroad in Baltimore last week, to discuss the building of a railroad from Buckhannon, W. Va., on the West Virginia & Pittsburgh Railroad, to Belington, on the West Virginia Central & Pittsburgh and Baltimore & Ohio railroads. The directors stated that if the county of Upshur, in which Buckhannon is located, voted $40,000 to the capital stock of the road, at the special election in March, they would aid in materially and perhaps take over the project and complete it.

Red River & Southwestern.—W. A. Squires, of Henrietta, Tex., reports that there is a fair chance of this railroad being built by a syndicate which is now being formed. He gives the route as from a point on the Chicago, Rock Island & Texas, in the Indian Territory, through Western Texas to San Angelo and to a connection with the Southern Pacific.

Richmond & Manassas.—A bill to incorporate this company has been the subject of lively discussion in the Virginia Legislature. The bill authorizes the company to build from Richmond northwesterly to Manassas to connect with the Baltimore & Ohio or with a projected branch of that road. The Richmond, Fredericksburg & Potomac, extending north of Richmond to Quantico, on the James River, where it connects with the Baltimore & Potomac, would be paralleled by the new railroad under the original bill, but an amendment made to the new charter provides that the company cannot parallel the Richmond, Fredericksburg & Potomac until the stock of the latter company owned by the State of Virginia, amounting to 4,678 shares, has been sold. A bill providing for this has also been introduced in the legislature.

Richmond & Northern.—This railroad is projected from the city of Richmond north to a point on the Potomac River, in King George or Westmoreland county. A branch to deep water on the Rappahannock River, 10 miles long, is also projected. A bill to charter the railroad has been introduced in the Virginia Legislature. The incorporators are A. Y. Stokes, Jr., Conway R. Sands, Henry A. Williams, Victor Williams, A. R. T. Lackey and Simon Cohen.

Roaring Creek & Charleston.—This company, which is building a line of railroad from Belington, W. Va., to Elkins, W. Va., a distance of 23 miles, has 18 miles graded and a large force at work on the remainder of the line. The road follows the valley of Roaring Creek, and connects with the West Virginia Central & Pittsburgh. The work of laying rails will be delayed a little on account of a bridge across the Valley River, at Harding, washing away in the flood last week, making it impossible to get supplies by rail till the bridge is replaced. A temporary bridge will be erected to carry construction trains and supplies.

Southbridge, Sturbridge & Brookfield.—Proposals will be received at the office of this company, 87 Milk street, Boston, Mass., until March 9, for the grading, masonry and bridge work on 13 miles of the road. The route is from Southbridge, through Sturbridge to East Brookfield, Mass. Frederic D. Fisk, of Boston, is President. S. L. Minot is consulting engineer of the road.

St. Louis, Chicago & St. Paul.—The company is now running its trains into Springfield, Ill., over its own tracks, having heretofore used the Wabash Line from Bates to Springfield, 12 miles. The extension into Springfield was practically completed in 1893. Part of the new line has been in operation, but the portion near Springfield has not been used because the company was unable to secure certain property in the city which was necessary to build the line into the station.

Streets Run & Homestead.—Incorporated in Pennsylvania to build a road from Hayes Station in Baldwin Township, thence east and northeast through Mifflin Township to Homestead, a distance of 1½ miles. John F. Cox, of Homestead, Pa., is President. The directors are Ira J. Wilson and James P. Wilson, of Pittsburgh, and Homer R. Swaney, of McKeesport, Pa.

Valley (Penn.).—This company was chartered in Pennsylvania on Feb. 14, to build a road from Levensville on the Western New York & Pennsylvania, to Lafayette, McKean County, Pa., and also from Levensville to a point four miles up Thunder Shower Run, in McKean County, a distance of 12 miles altogether. Charles A. Weed, of Binghamton, N. Y., is President.

Virginia, Seaboard & Western.—A bill to incorporate this company is now under discussion in the Virginia Legislature. The charter is for a road from Danville across the state to Bristol, Tenn., or to a connection with the East Tennessee, Virginia & Georgia, on the Norfolk & Western near that town. The incorporators are C. W. Grandy, Mayer Lyman, R. B. Tunstall, W. W. Old, W. B. Hatcher, Caldwell Hardy and Edward Brockenbrough. It is said that this charter is being asked for by those interested in the Atlantic & Danville, which is to be sold at foreclosure in April and that it is the purpose to reorganize that company under the new charter.

Westport & Waldo.—This company, with a capital stock of $200,000, has been incorporated in Missouri to build a railroad from Kansas City to Waldo Park, in Jackson County, a distance of eight miles. The incorporators are Lee K. Mooney, of Westport, Mo., and W. E. Winner, C. B. Adams, E. S. Young and George Law, of Kansas City.

Wheeling Bridge & Terminal.—The authorities of Benwood, W. Va., have delayed work on the Benwood extension, by claiming that the company had no right to lay its tracks on certain streets under the ordinance granting it the right of way, until it should have paid to the abutting property owners damages assesed by arbitration. Receiver Brewster applied to the United States Circuit Court and secured an injunction restraining the city officials from interfering with the company's operations. The work has been resumed between the Ohio County line and Benwood city. The road will be completed to the Riverside Iron Works, three miles, the objective point, in another month if there are no further complications.

White Day Land & Transportation Co.—This company, which was mentioned two weeks ago as intending to build a railroad from Irontown, Taylor County, W. Va., to Opekiska, Monogalia County, W. Va., has had surveys made and secured some right of way. Messrs. Porter Haskell, of Clarion, Pa., and William McGee and Michael Boice, of Pittsburgh, Pa., have run the lines from Irontown to Opekiska. The line is to follow White Day Creek nearly all the way, from a connection with the Baltimore & Ohio at Irontown, and will be about 22 miles in length. The road is to be built for the purpose of developing timber and coal lands.

Wilkes-Barre & Eastern.—Work will soon be commenced on a branch to be constructed from the main line at a point above Mill Creek, Pa., to the Erie & Wyoming Valley. The route was surveyed last summer. The chief object of the new branch will be to reach the Pennsylvania Coal Company's mines.

GENERAL RAILROAD NEWS.

Atlantic & Danville.—The approaching foreclosure sale of this road, which has been fixed for April 3, has given rise to a number of reports concerning the disposition to be made of the property. It was reported that the line would be secured by the Richmond & Danville, but this story hardly needed the denial which has been secured from President W. G. Oakman. Another report is that the Virginia Seaboard & Western, now asking a charter in Virginia for a line from Danville to Bristol, is simply another name for this company. It is probable that the property will be purchased by the bondholders when the sale takes place.

Carthage, Watertown & Sackett's Harbor.—The question of the legality of the last annual election of this company at which H. Walter Webb and others interested in the New York Central & Hudson River Railroad were elected Directors of the company, was decided last week at Syracuse, by Justice Vann, in Special Term, against the New York Central. The suit turned on the right of the Commissioners of the town of Watertown, N. Y., to sell the stock owned by that city to the New York Central Railroad, the Judge deciding adverse to the Commissioners and the New York Central Railroad. The present title of the New York Central to this stock was not passed upon. Since the last annual election the town of Watertown has ratified the sale of the stock, and it has acquired practically the entire capital stock of the railroad. The road is a branch of the Rome, Watertown & Ogdensburg.

Central of Georgia.—A new reorganization scheme for this property is being discussed by certain New York interests, and it is announced that they have already secured the consent of the floating debt creditors to deposit the collateral securities held by them with the Mercantile Trust Co., of New York. Gen. Samuel Thomas and T. F. Ryan, of New York, are the chief promoters of the plan. It is understood that they propose a new issue of debenture bonds amounting to $13,000,000 to take the place of the consolidated mortgage bonds provided for in the Hollins reorganization plan which failed to secure the consent of a sufficient amount of the security holders. The proceeds of the bonds would be used to cancel the floating debt and for other purposes of reorganization.

Chicago, Burlington & Quincy.—It is announced that an agreement has been made with the officers of the Terminal Association of St. Louis by which this company will use the Union station at St. Louis and run all its passenger trains into that station instead of into the company's own station in the northern part of St. Louis at Mallanphy street. It had been announced that the through trains of this company, as well as of the Missouri, Kansas & Texas, which has a contract to enter St. Louis over this company's tracks, would run into the Mallanphy street station, which was erected chiefly for suburban business. It will be necessary to extend the present Terminal tracks about two miles to connect with the Burlington tracks, and this work, it is claimed, can be done for $125,000 and completed by the time the new Union station is ready for use.

Frankfort & Southeastern.—The movement for a Receiver for this road has ended in the appointment of Wellington R. Burt as Receiver. Mr. Burt is now Receiver of the Toledo, Ann Arbor & North Michigan, which operates the Frankfort & Southeastern. The order of the court extends his authority as Receiver over the latter line, but directs that the accounts of the two companies be kept separate. The suit for a Receiver was brought by A. C. Hale as trustee of the first mortgage bonds amounting to $253,000. The road was built in 1890 from Beecher to Frankfort on Lake Michigan, about 23 miles. In 1892 the control of the stock was secured by the Toledo, Ann Arbor & North Michigan, which has since operated the road.

International & Great Northern.—The preliminary arguments of the attorneys in the suit brought by the State of Texas to have declared illegal the lease of the Galveston, Houston & Henderson road to the above railroad, were heard before the Texas District Court at Galveston last week. The International & Great Northern applied for a change of venue to another county, and this has been granted.

Kentucky Union.—The foreclosure sale of this road under the judgment secured by J. Kennedy Tod & Co., of New York City, will take place at Lexington, Ky., on March 14.

Nevada Southern.—The Receivers of the Atlantic & Pacific have procured a judgment for $67,000 against this railroad company, and have attached the property in California for that amount. The company has in operation a line 30 miles long, from Blake, on the Atlantic & Pacific, to mines near the Naveda state line.

New York, Lake Erie & Western.—Despite the considerable talk of opposition to the announced plan of reorganization it is stated that 500,000 shares of the common and preferred stock have already assented to the plan and that its success is assured. Drexel, Morgan & Co. are expected to declare the plan operative in a few days.

New York & New England.—The attachment for $300,000 on the equipment of this company which was secured by the Receiver of the Philadelphia, Reading & New England Railroad on claims for unsettled balances has been released. The attachment on the cars and engines was made by order of Receiver Sherwood, of the Philadelphia, Reading & New England, at Hartford. It was made after the appointment of T. C. Platt as temporary Receiver, though before the appointment of Receivers Hart and Perry and it was claimed by the railroad that the attachment therefore was not legal. This point has been waived and the New England company acknowledges the claim of Receiver Sherwood, and it is announced has agreed to pay it off in installments of $10,000 weekly.

Austin Corbin, Sidney Chase, and J. M. MacDonald have been appointed a committee to investigate the acts of the recent management of the railroad. A committee comprising John I. Waterbury, Henry W. Cannon and T. Jefferson Coolidge, has been formed to undertake the reorganization of the property. A stock assessment of at least 7 or 10 per cent. is generally conceded to be necessary and the bondholders will be asked to fund their coupons for several years.

Northern Central.—The annual report for the year ending Dec. 31, 1893, shows gross earnings of $6,881,806, a decrease from 1892 to $309,484; operating expenses of $4,763,156, a decrease of $349,203, and net earnings of $2,118,650, a gain of $39,719. In addition to the net earnings from traffic, the company received $470,454 from dividends and interest, and $26,529 from interest on equipment, making a total of $2,615,633. After payment of cash dividends of 8 per cent. the surplus was $560,194.

Philadelphia & Erie.—The Directors have declared a two per cent. dividend on the common stock of this road, the second dividend declared on the stock, the first having been in March, 1892. The annual report recently issued showed that the company had on Dec. 31 over $626,000 in cash. Since that time interest charges of $260,000 have been paid, so that the company has $366,000 applicable to dividends. The amount declared will require $159,000. The city of Philadelphia will receive $50,000 on the stock which it holds, and the Pennsylvania Railroad, which owns the controlling interest, will receive about $85,000.

At the recent annual meeting of the minority stockholders it was urged that more detailed information of the company's affairs ought to be published, and a resolution was passed asking the directors to appoint a committee to prepare a full report on the finances of the company. The minority stockholders claimed that the relations between the company and the Pennsylvania Railroad were not as advantageous to the Philadelphia & Erie as they might be made. The directors have since appointed a committee to make a thorough examination of the whole question. They say that this report will show the minority stockholders that their interests have been fairly dealt with, and that only through the advances and credit obtained in other through the Pennsylvania company would the company be now able to pay a dividend.

Philadelphia & Reading.—The issue of coal trust notes, which has been proposed for some time, has been decided upon by the Receivers, the amount to be authorized being $5,000,000. The new plan of reorganization now under consideration will probably be announced shortly. This plan contemplates an issue of $10,000,000 collateral trust bonds, and the funding of the general mortgage coupons. The collateral trust bonds have been practically underwritten. Of the coal trust notes, Drexel & Co. and Brown Bros. & Co. will take $2,500,000, and the Finance Company of Pennsylvania $2,500,000. Only $5,000,000 in all will be issued, though $5,500,000 was the original amount contemplated.

Piedmont & Cumberland.—The directors of the West Virginia Central & Pittsburgh last week ratified a lease of the Piedmont & Cumberland, made possible by the withdrawal of the suits against such a proceeding by Maj. Alexander Shaw, under an agreement reached between him and President Henry G. Davis. The lease provides that the West Virginia Central & Pittsburgh Co. shall operate the Piedmont & Cumberland road for 63 per cent. of the gross receipts. About three years ago such a lease was about to be made when Maj. Alexander Shaw filed a bill in the Circuit Conrt at Baltimore to enjoin the lease and secured an injunction. Recently this suit has been decided against Major Shaw and the lease held to be proper. All further opposition to the lease has been overcome by Major Shaw selling his stock in the West Virginia Central & Pittsburgh road to President Davis.

Port Royal & Augusta.—An issue of Receivers' certificates to the amount of $50,000 has been authorized by the court, and the Receiver, J. H. Averill, of Augusta, is authorized to erect a new bridge over the Savannah River near Augusta and make various maintenance of way improvements.

Richmond, Fredericksburg & Potomac.—A bill is now before the Virginia legislature authorizing the Board of Sinking Fund Commissioners to sell the State's interest in the above railroad. This amount is about 4,678 shares, and a sale is to be made at a figure not less than the price at which the stock was quoted on Feb. 13. This bill has been discussed in connection with the bill chartering a proposed railroad which would parallel this road, and the bill mentioned above is introduced to facilitate the passage of the charter of the new company.

Southern Pacific.—The preliminary report of this company for the year ending Dec. 31 shows:

	1893.	1892.	Inc. or dec.	
Gross earnings	$48,049,548	$18,972,196	D.	$922,648
Oper. expen.	30,576,244	31,288,199	D.	711,955
Net earnings	$17,473,303	$17,683,995	D.	$210,691
Other income	849,230	787,765	I.	61,465
Total income	$18,322,534	$18,471,760	D.	$149,225
Fixed charges	16,330,026	15,861,411	I.	468,615
Surplus	$1,992,508	$2,610,319	D.	$617,841

Southwestern of Georgia.—The stockholders at a meeting in Macon, Ga., on Feb. 9, voted to authorize the directors at their discretion to assume the operation of the railroad and withdraw the company's property from the control of the Receivers of the Central of Georgia. This does not mean, however, that the road will be immediately withdrawn from the Central of Georgia system and operated independently, as has been supposed. The resolution submitted and approved by the stockholders provides first of all that a committee of directors be appointed to confer with the Reorganization Committee of the Central of Georgia to ascertain what conditions will be offered the Southwestern bond and stockholders in the contemplated reorganization, and if the proposition made is not satisfactory to the directors they are then authorized to withdraw the railroad property and operate it in its own name. In the meantime the railroad will continue to be operated as one of the Central of Georgia lines. The resolutions approved by the stockholders were passed by a majority of the directors on Dec. 27, and after authorizing the separation of the company's lines from the rest of the Central of Georgia road, authorized the directors to arrange for the lease or rental of the equipment; to issue $6,000,000 of first mortgage bonds; to provide first for any liability adjudged against the company upon the so-called "tripartite" bonds; to secure control of the Montgomery & Eufaula and the Mobile & Girard, and to provide for equipment and betterments.

Valley (Ohio).—The reorganization of this road has been delayed by the opposition of certain minority bondholders to the plans proposed by the Baltimore & Ohio for the reorganization. These bondholders have opposed the foreclosure as formulaed, but recently there have been meetings between the various interests and it is stated that the opposition will probably be withdrawn. If the bondholders decide to withdraw the suits they have brought in the courts against the foreclosure proceedings, the reorganization of the company will probably be carried out immediately.

West Virginia Central & Pittsburgh.—Maj. Alexander Shaw and President Henry G. Davis, of the West Virginia Central & Pittsburgh Railroad, and others interested have reached an amicable settlement of the differences which have led to so much litigation between them in the past five or six years. By the terms of the adjustment, the stock in the railroad held by Major Shaw is transferred to Mr. Davis and members of his family. Mr. Davis and Major Shaw mutually agree to dismiss all suits pending against either of them personally or against the railroad, and no new suits are to be brought by either in the matters now pending or upon any past questions. Major Shaw, as one of the terms of the agreement, has withdrawn from the directory. The agreement was reached through the mediation of Mr. John Gill, of the Mercantile Trust Co. of Baltimore, on behalf of Major Shaw, and John A. Hambleton for Mr. Davis. By the agreement, 9,900 shares of the West Virginia Central & Pittsburgh stock, the entire holding in the control of Major Shaw, will be transferred to Mr. Davis. The price paid for the stock is less than the stock has sold for in open market. The authorized capital stock of the West Virginia Central & Pittsburgh Railroad is $6,000,000 in 60,000 shares. Only 55,000 shares have been issued, the company retaining in its treasury 5,000 unissued shares. Including the purchase just made, President Davis and the members of his family hold 46,000 shares of the 55,000 issued, giving them complete control of the corporation.

TRAFFIC.

Traffic Notes.

The Cincinnati Freight Bureau has filed a bill of complaint with the Industrial Commerce Commission against the Baltimore & Ohio, Baltimore & Ohio Southwestern, Pennsylvania, Big Four, Lake Shore and Cincinnati, Hamilton & Dayton, charging that official classification No. 12 is in violation of Section 1 of the Interstate Commerce law in that it exacts oppressive conditions from shippers.

Chicago Traffic Matters.

CHICAGO, Feb. 21, 1894.

Western railroad men who attended the conference with the Interstate Commerce Commission at Washington are not very well pleased with the form of through tariffs which they were asked to approve.

The Union Pacific continues to be a disturbing element in Western passenger circles and matters are getting worse every day. In Central traffic territory the situation has become so serious that a special meeting was held yesterday to see if something could not be done at once to stop the demoralization, but so far as known nothing was accomplished.

Freight traffic continues light. Charges of cuts continue to be freely made, especially in the rates on corn eastward.

The Chicago, Milwaukee & St. Paul will put in effect March 1 a rule requiring conductors and collectors to take up all coupons and local tickets reading beyond their run, and issue in lieu continuous train checks.

The General Managers' Association held a meeting last week and further considered the switching problem at the Stockyards.

It now looks as though the Southern Pacific was determined to carry out its threat against the Santa Fe at all hazards. It has given notice to its connections to withdraw the sale of tickets to San Francisco via the Santa Fe and Los Angeles on March 1. Just what action will be taken by the Santa Fe remains to be seen. The present tariff to Southern California points, including Los Angeles, is the same via Ogden, Lathrop and Sacramento as via the Santa Fe. The withdrawal of through tickets via Los Angeles will force passengers to pay the local rate of $15 from Los Angeles to San Francisco. The most feasible way for the Santa Fe to meet this will be to reduce the Chicago-Los Angeles rate by that amount. This in turn will cause a reduction via Ogden, which will reduce the San Francisco and Portland rate, so it looks as though the Santa Fe had decidedly the best of the situation. The Southern Pacific is endeavoring to get even with the Santa Fe for steadily refusing to allow it to make the same rate eastbound from Los Angeles via San Francisco as is now made via the Santa Fe and via Sacramento. The Santa Fe insists on a $4 difference via San Francisco.

The Chicago-Missouri River lines have refused to accede to the request of the lines west of the Missouri River to make a round trip rate of $14.50 between Chicago and the river in connection with the $65.50 round-trip rate from the Missouri to San Francisco for the Midwinter Fair. The lines West want a round-trip rate of $80, and will probably reduce their rates in order to make it.

Western lines are again in trouble about the sale of tickets in hotel offices. Under a recent ruling of the chairman of the Western Passenger Association, members were allowed to put tickets on sale with two tourist agencies to meet the competition of the Burlington. The Minneapolis & St. Louis road declares its intention of meeting competition at Minneapolis by placing its tickets in the West Hotel.

Eastern lines have made some little progress in perfecting an agreement to divide eastbound freight traffic from Chicago, but it is not likely to become operative while the Interstate Commerce law remains as now. Some progress has also been made toward a reorganization of the Chicago & Ohio River Association.

The shipments of eastbound freight, not including livestock, from Chicago, by all the lines, for the week ending Feb. 17 amounted to 48,131 tons, against 47,539 tons during the preceding week, an increase of 592 tons, and against 75,663 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	W'k to Feb. 17.		W'k to Feb. 10.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	4,721	9.8	5,035	10.6
Wabash	4,633	9.6	2,968	6.3
Lake Shore & Michigan South.	7,910	16.4	8,371	17.6
Pitts., Ft. Wayne & Chicago.	5,389	11.2	5,445	11.5
Pitts., Cin., Chicago & St. Louis	6,933	14.4	7,731	16.3
Baltimore & Ohio	3,003	6.8	2,792	5.9
Chicago & Grand Trunk	4,098	8.5	3,313	6.9
New York, Chic. & St. Louis	5,210	10.8	4,518	9.5
Chicago & Erie	4,363	9.1	5,529	11.6
C., C., C. & St. Louis	1,871	3.4	1,837	3.8
Totals	48,131	100.0	47,539	100.0

Of the above shipments 3,067 tons were flour, 31,057 tons grain and millstuff, 8,897 tons cured meats, 9,489 tons dressed beef, 1,372 tons butter, 1,021 tons hides and 1,934 tons lumber.

(Other Chicago traffic news will be found on page 133).